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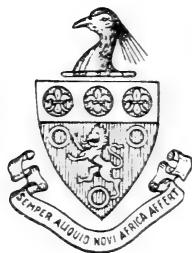
ANNALS
OF THE
SOUTH AFRICAN MUSEUM

VOLUME XXX



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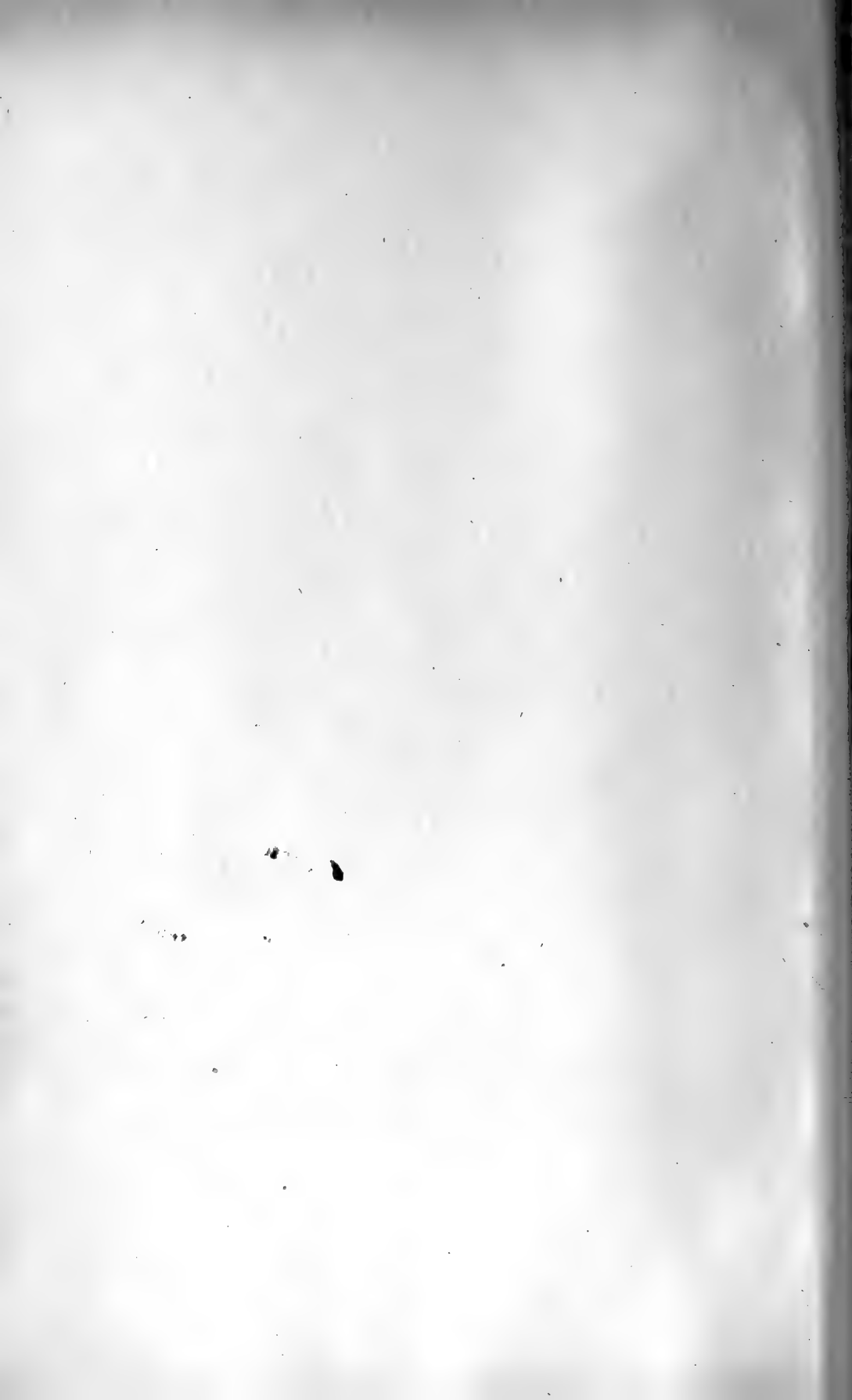
VOLUME XXX



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LIST OF CONTRIBUTORS.

	PAGE
E. ASHBY.	
Monograph of the South African Polyplacophora (Chitons) . . .	1
K. H. BARNARD.	
Contributions to the Crustacean Fauna of South Africa. No. 11.	
Terrestrial Isopoda	179
South African Stone-flies (Perlaria)	511
Notes on South African Fishes	645
M. BERNHAUER.	
The Staphylinid Fauna of South Africa	481
A. J. HESSE.	
Some Insects associated with the Plant <i>Gnidia (Arthrosolen) laxa</i> Gilg. .	397
J. HEWITT.	
A New Solifuge and Scorpion from South West Africa	93
R. F. LAWRENCE.	
A New Peripatopsid from the Table Mountain Caves	101
New South African Solifugae	131
New South African Opiliones	549
F. SILVESTRI.	
A Contribution to a Knowledge of the South African <i>Japagidae (Insect,</i> <i>Thysanura)</i>	61
J. L. B. SMITH.	
The Fishes of the Family <i>Mugilidae</i> in South Africa	587
R. J. TILLYARD.	
On a Collection of Stone-flies (Order <i>Perlaria</i>) from South Africa. .	109
J. R. LE B. TOMLIN.	
Reports on the Marine Mollusca in the Collections of the South African Museum. VI-VIII	157
J. R. LE B. TOMLIN and F. A. SCHILDER.	
Reports on the Marine Mollusca in the Collections of the South African Museum. IX	477

E. UHMANN.		PAGE
South African Hispinae from the South African Museum . . .		389
H. WOMERSLEY.		
A South African species of <i>Protura</i>		89
Some Collembola of the Family <i>Sminthuridae</i> from South Africa . . .		137
Some South African <i>Machilidae</i> (<i>Thysanura</i>)		171
On some Collembola <i>Arthropleona</i> from South Africa and Southern Rhodesia		441

LIST OF NEW TRIBAL, GENERIC, AND SUBGENERIC NAMES INTRODUCED IN THIS VOLUME.

	PAGE
Angaribia n. subg. Periscyphis, Armadillidiidae (Crustacea, Isopoda), BARNARD	295
Aphanicerca n. g. Nemouridae (Perlaria), TILLYARD	117
Aphanicerella subg. Aphanicerca, Nemouridae (Perlaria), TILLYARD	124
Aphaniceropsis n. g. Nemouridae (Perlaria), BARNARD	532
Benthanops n. subg. Philoscia, Oniscidae (Crustacea, Isopoda), BARNARD	247
Charitodoron n. g. Buccinidae (Mollusca), TOMLIN	167
Climacoporus n. g. Clinidae (Pisces), BARNARD	645
Desmonemoura n. g. Nemouridae (Perlaria), TILLYARD	126
Eparchiini n. trib. Staphylinidae (Coleoptera), BERNHAUER	481
Eparchium n. g. Staphylinidae (Coleoptera), BERNHAUER	481
Exzaes n. g. Armadillidiidae (Crustacea, Isopoda), BARNARD	299
Hekelus n. g. Armadillidiidae (Crustacea, Isopoda), BARNARD	297
Hiatoniscus n. g. Oniscidae (Crustacea, Isopoda), BARNARD	283
Hora n. g. Oniscidae (Crustacea, Isopoda), BARNARD	229
Inchanga n. g. Oniscidae (Crustacea, Isopoda), BARNARD	277
Kogmania n. g. Trichoniscidae (Crustacea, Isopoda), BARNARD	208
Komatia n. subg. Philoscia, Oniscidae (Crustacea, Isopoda), BARNARD	240
Krantzia n. g. Oniscidae (Crustacea, Isopoda), BARNARD	280
Manibia n. subg. Niambia, Oniscidae (Crustacea, Isopoda), BARNARD	269
Marioniscus n. g. Oniscidae (Crustacea, Isopoda), BARNARD	234
Neophorella n. g. Tomoceridae (Collembola), WOMERSLEY	464
Paramontia n. g. Triaenonychidae (Arachnida), LAWRENCE	566
Paranotoniscus n. g. Trichoniscidae (Crustacea, Isopoda), BARNARD	202
Pareiobledius n. subg. Bledius, Staphylinidae (Coleoptera), BERNHAUER	495
Pseudoprocirrus n. g. Staphylinidae (Coleoptera), BERNHAUER	506
Roewerania n. g. Triaenonychidae (Arachnida), LAWRENCE	573
Umtaliella n. g. Assamiidae (Arachnida), LAWRENCE	549

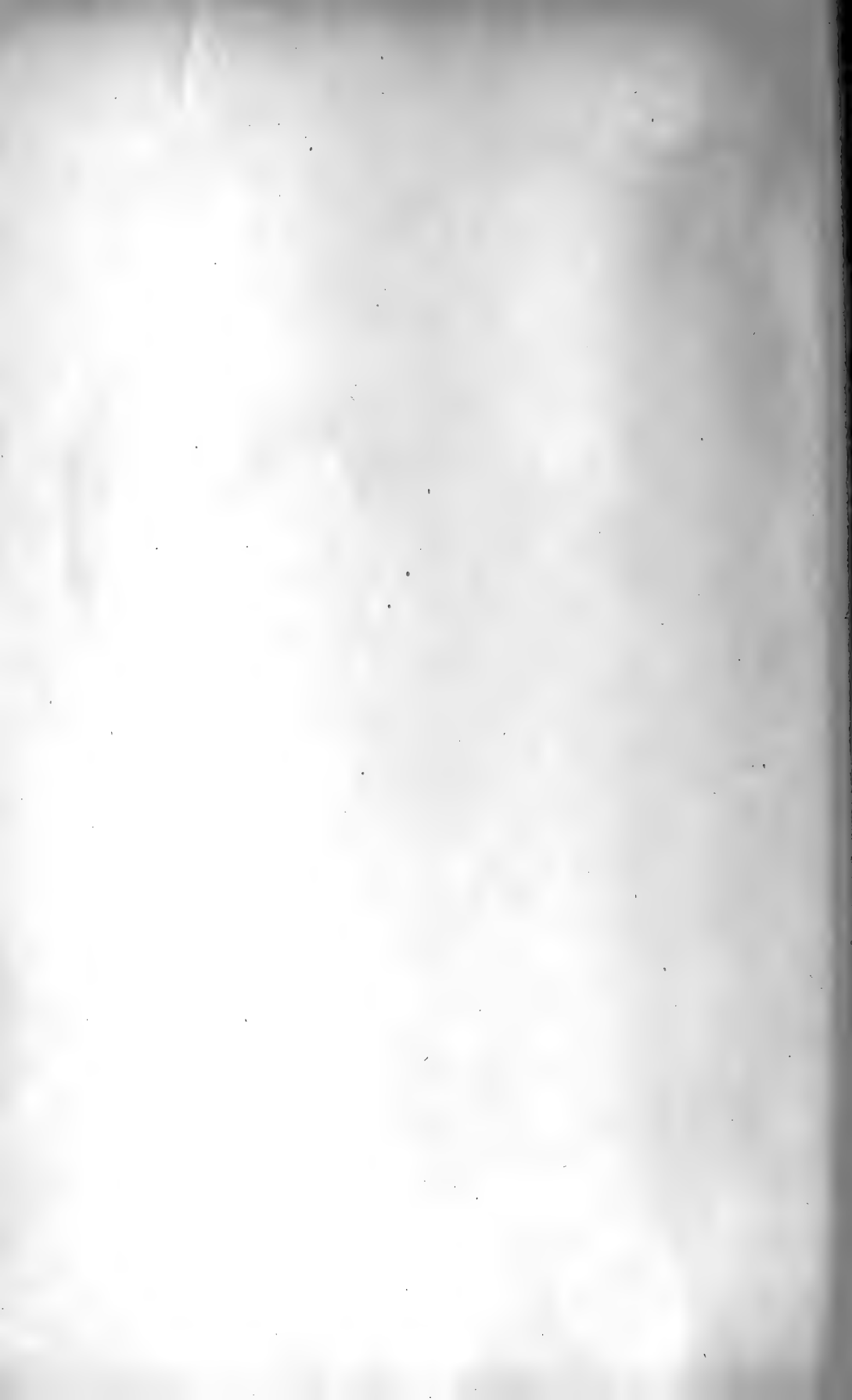
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- Part 5. January 1935.

LIST OF PLATES.

PLATES

- I-VII. South African Chitons.
VIII. *Sminthurinus niger* Lubbo.
IX. *Sminthurinus terrestris* n. sp.
X. *Sminthurinus pallidus* n. sp.
XI. *Rastriopes lineata* n. sp.
XII. *Deuterosminthurus marmoratus* n. sp.
XIII. *Dicyrtomina minuta* O. Fabr. form *africana* n.
XIV. *Eparchium paradoxum* n. g., n. sp.
XV-XXII. South African *Mugilidae*.
XXIII-XXV. *Rhineodon typus* A. Smith.



INDEX OF GENERA.

A		PAGE			PAGE
<i>Acanthochites</i>	.	7, 10	<i>Chiton</i>	7, 15, 18, 22, 23, 27, 30, 32,	36, 38, 49, 50, 53
<i>Acanthochiton</i>	.	7, 52, 53	<i>Choneplax</i>	.	53
<i>Acanthochiton</i>	.	10	<i>Clathropleura</i>	.	42
<i>Acanthopleura</i>	.	49, 53	<i>Climacoporus</i>	.	645
<i>Acanthopleura</i>	.	27	<i>Craspedochilus</i>	.	16
<i>Acerentulus</i>	.	90	<i>Cryptoplax</i>	.	12
<i>Achorutes</i>	.	451	<i>Cubaris</i>	.	376
<i>Adaeulum</i>	.	575	<i>Cubaris</i>	303, 308, 315, 328, 375	
<i>Akermania</i>	.	318	<i>Cyphoderus</i>	.	465
<i>Alloniscus</i>	.	231	D		
<i>Anchicubaris</i>	.	380	<i>Dactylispa</i>	.	391
<i>Anchiphiloscia</i>	.	241, 245	<i>Daesia</i>	.	134
<i>Angaribia</i>	.	295	<i>Dascyllus</i>	.	645
<i>Anisopsis</i>	.	487	<i>Desmonemoura</i>	.	126, 546
<i>Anthochiton</i>	.	42	<i>Deto</i>	.	220
<i>Anurida</i>	.	451	<i>Deuterosminthurus</i>	.	149
<i>Aphanicerca</i>	.	117, 523	<i>Dicaiothrips</i>	.	434
<i>Aphanicerella</i>	.	124, 536	<i>Dicyrtomina</i>	.	150
<i>Aphanicerceopsis</i>	.	532	<i>Dinoplax</i>	.	27
<i>Aphiloscia</i>	.	238	<i>Diodora</i>	.	159, 160
<i>Apogon</i>	.	645	<i>Diploexochus</i>	.	323
<i>Arhina</i>	.	231	<i>Dorcatthispa</i>	.	391
<i>Armadillidium</i>	.	382	E		
<i>Armadillo</i>	301, 320, 323, 376		<i>Edaphus</i>	.	501
<i>Austromontia</i>	.	568	<i>Emarginula</i>	.	162
B			<i>Entomobrya</i>	.	458
<i>Balyana</i>	.	391	<i>Eparchium</i>	.	481
<i>Benthanops</i>	.	247	<i>Eubelum</i>	.	385
<i>Bethalus</i>	.	301	<i>Eudoxochiton</i>	.	18
<i>Biacumontia</i>	.	571	<i>Eudoxoplax</i>	.	18
<i>Bledius</i>	.	493	F		
<i>Brachystomella</i>	.	449	<i>Fasciolaria</i>	.	157
C			<i>Fissuridea</i>	.	160
<i>Cadella</i>	.	582	<i>Friezea</i>	.	447
<i>Callispa</i>	.	389	G		
<i>Callochiton</i>	.	18	<i>Gerufa</i>	.	272
<i>Ceratina</i>	.	424	<i>Gigarthrus</i>	.	496
<i>Ceratomontia</i>	.	551	<i>Glypteuthria</i>	.	165
<i>Ceratrimeria</i>	.	448			
<i>Cercocytonus</i>	.	292			
<i>Charitodoron</i>	.	167			
<i>Chelypus</i>	.	94			
<i>Chiton</i>	.	42, 43			

H		PAGE	
Hanleya		16	
Hanleya		15	
Hekelus		297	
Hiatoniscus		283	
Hispa		393	
Holotrochus		497	
Hoplitopales		413	
Hora		229	
Hormiopterus		418	
Hypergnathus		286	
Hypogastrura		444	
Hypomachilodes		174	
I		PAGE	
Inchanga		277	
Ischnochiton		29, 53	
Ischnochiton		23, 44	
Isotoma		454	
Isotomodes		453	
Isotomurus		453	
J		PAGE	
Japyx		61, 84	
K		PAGE	
Kogmania		208	
Komatia		240	
Krantzia		280	
L		PAGE	
Larifuga		579	
Larifugella		577	
Lawrencella		566	
Lepidochiton		18	
Lepidocyrtinus		460	
Lepidocyrtoides		465	
Lepidocyrtus		459, 463	
Lepidopleurus		15	
Leptotrichus		259	
Ligia		184	
Ligyda		184	
Liolophura		49	
Lispinodes		484	
Lispinus		483	
Liza		587	
Loboplax		10	
M		PAGE	
Machilellus		176	
Machiloides		171	
N		PAGE	
Nahia		245	
Neoperla		519	
Neoperla		114	
Neophorella		464	
Niambia		257	
Notoplax		10	
O		PAGE	
Ochthopetina		114, 518	
Oedichirus		507	
Oncocephala		391	
Onithochiton		50, 53	
Onithochiton		10	
Onychiurus		452	
Oonopsopilio		582	
Opisthophthalmus		96	
Oxytelus		487	
P		PAGE	
Pagrus		651	
Parajapyx		82	
Paramontia		566	
Paranotoniscus		202	
Parmaphorella		163	
Peripatopsis		101, 102, 10	
Periscyphis		292	
Periscyphops		295	
Philoscia		235, 249	
Philougria		194	
Phloeonomus		484	
Phlyctaenodes		425	
Phylloniscus		205	
Pinophilus		502	
Platypria		395	
Platysthetus		492	
Plaxiphora		20, 53	
Plaxiphora		50	
Polyacanthella		447	
Polyacanthus		320	
Porcellio		251	
Porcellionides		254	
Proisotoma		456	
PseudhisPELLA		391	
Pseudoprocirrus		506	
Pseudosira		459	

Index of Genera.

xv

R		T	
	PAGE		PAGE
Radsella	29, 36	Termitoniscus	211
Ranzania	657	Tetradrachmum	645
Rastriopes	144	Thinobius	496
Roewerania	573	Thomsonia	257
Roeweria	566	Titana	208
Rhacodes	213	Trachydermon	16
Rhampsinitus	584	Trachyradsia	18
Rhineodon	647	Trichispa	393
Rhyscotus	286	Trichoniscus	194
Rhyssoplax	42	Triviella	477
		Trogophloeus	486
		Tulbergia	453
		Tylos	213
S		U	
Schöblia	211	Umtaliella	549
Setaphora	241		
Sminthurinus	137	V	
Solpuga	93, 131	Vertagopus	455
Sphenoptera	416		
Spongiolithon	10	X	
Stenomacrus	286	Xenylla	446
Stenus	497		
Stereochiton	18		
Sturmia	428		
Sypharochiton	47		



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VOLUME XXX.

PART I, containing:—

1. *Monograph of the South African Polyplacophora (Chitons).*
By EDWIN ASHBY, F.L.S. (With Plates I–VII and 2
Text-figures.)
2. *A Contribution to a Knowledge of the South African
Japygidae (Insecta, Thysanura).* By F. SILVESTRI.
(With 24 Text-figures.)
3. *A South African Species of Protura.* By H. WOMERSLEY,
A.L.S., F.E.S. (With 2 Text-figures.)
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Africa.* By R. J. TILLYARD, M.A., Sc.D. (Cantab.),
D.Sc. (Sydney), F.R.S., F.L.S., F.G.S., F.E.S., F.N.Z.Inst.,
C.M.Z.S. (With 13 Text-figures.)
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8. *Some Collembola of the Family Sminthuridae from South
Africa.* By H. WOMERSLEY, A.L.S., F.E.S. (With
Plates VIII–XIII.)



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1. *Monograph of the South African Polyplacophora (Chitons).*—By
EDWIN ASHBY, F.L.S.

(With Plates I–VII and 2 Text-figures.)

In Mr. Ashby's Monograph twenty-four species and three varieties are described, and for the most part figured, from South African waters. As in other papers dealing with the marine fauna, the limits of South Africa are reckoned as extending on both the east and west coasts up to 15° S. lat. In addition, Mr. Ashby re-describes one species from Tristan da Cunha, and describes a new species from Madagascar, as well as giving a list of Madagascan Chitons which may be proved by later collecting to occur also within our limits.

Of the material examined by Mr. Ashby, examples of four species have been contributed by both the Oxford Museum and the United States National Museum; examples of two species each by the British Museum, the Albany Museum, the Natal Museum, and the Transvaal Museum; and examples of eighteen species by the South African Museum.

The South African Museum material was originally placed in the hands of Mr. J. R. le B. Tomlin, together with the whole collection of marine Mollusca, but was transferred to Mr. Ashby for the purpose of this monograph with Mr. Tomlin's concurrence.—EDITOR.

INTRODUCTION.

THE name Chiton (Greek for an armoured tunic or coat of mail) was proposed by Linne (1758) and has been universally adopted as the vernacular name of members of the order Polyplacophora. Iredale and Hull (Austr. Zoologist, iii, 5, pp. 186, 187, 1923) have proposed the substitution of the word Loricates, but as there is no International Rule making such an alteration necessary, its adoption would be most undesirable.*

* It would seem, however, that under the International Rules *Loricata* Schumacher, 1817, should displace *Polyplacophora* Gray, 1821.—EDITOR.

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The Animal.—Chitons are “stomach-footed” as in the Gasteropoda, are furnished with gills or ctenidia on either side, which, according to the family, may extend from only a quarter to the full length of the foot; the head is separated from the foot and is furnished in common with other Gasteropoda with a radula, a flexible tongue or lingual ribbon, which is armed with teeth and is used for rasping food, consisting chiefly of various forms of alga. The animal on the upper side is protected by a sort of “coat of mail,” consisting of eight separate

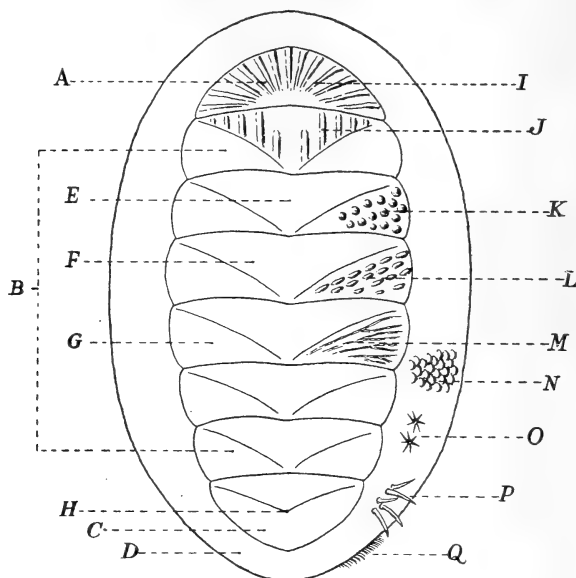


FIG. 1 (Explanations, p. 55).

pieces of shell termed valves, which are held together by a flexible leathery girdle. The shell is bilaterally symmetrical. There are three distinct methods of sculpture in each individual, that of valve 1, termed the head valve or anterior valve, that of valve 8, termed the tail valve or posterior valve, and that of the six intermediate valves, termed median valves, or by some authors central valves. Each valve is composed of two layers, the outer called the “tegmentum” and the inner the “articulamentum”; between these two layers ramify channels for the nerve fibres.

Sculpture of the Tegmentum.—*Head Valve*—this may be smooth, grooved, radially ribbed or granulose (these variations of sculpture are common to all the valves). *Tail Valve*—this is furnished with a raised apex termed the “mucro,” which may be anterior, central,

posterior, or terminal; the posterior portion of this valve is in sculpture more or less the same as the lateral areas of the median valves, the anterior portion similar in varying degrees with that of the dorsal-pleural areas of the six median valves. *Median Valves*—vary in the same specimen considerably as to size and shape, but all six are sculptured on the same pattern. The ridge is termed the “dorsal area” or “juguín”; this often protrudes posteriorly in what is termed the “beak” or “umbo,” is often wedge shaped, sometimes linear, and smooth, grooved, or granulose. There are two pleural areas (either side), forming the anterior portion of the valve and abutting on the dorsal area on one side and the girdle on the other. There are two lateral areas which form the posterior portion of the valve and which in many species is raised; the raised line dividing this area from the pleural is often termed the diagonal.

Inside or Articulamentum.—Except in the most primitive genera the articulamentum is extended beyond the tegmentum in what is termed “the insertion plate.” This plate may be entire or divided into a number of “teeth,” the teeth may be smooth-edged, serrate, or laminate. (The insertion plate is a survival factor, developed to increase the strength of the attachment of the protecting shell to the body.) The tegmentum also extends forward somewhat, leaving a wedge-shaped gap between it and the insertion plate; this is termed the “eaves.” There is a forward development of the articulamentum at the “sutures,” under the valve immediately in front, which forms the hinge, and is usually in two pieces termed the “sutural laminae”; the gap between is called the “jugal sinus.”

The Girdle.—The girdle varies greatly in different genera; in some it is narrow, in others capable of great extension; the girdle clothing, armature, or ornamentation (all terms used) may consist of imbricate scales, erect scales, spicules (termed also setae), bristles or hairs. In most cases the scales and spicules are superficially or epidermally attached, in which case they are by themselves only of specific value, but others also possess peculiar setae (which have been termed “deep-seated”) which seem deserving of generic valuation; thus, for example, members of the subfamily Acanthochitoninae extrude bunches of spicules through pores placed at the sutures of the valves.

Nervous System.—As has been before stated, numberless nerve-channels ramify between the tegmentum and articulamentum, connecting with the body through pores in the articulamentum and through the “eaves” with the girdle, and also through numberless minute perforations in the tegmentum termed “megalo-pores” (the

smaller of these sometimes called "micropores"); also, in some genera, sense-organs termed "eyes" are present in portions of the tegmentum, and function, it is believed, analogously with that organ.

Ecology.—The greater number of genera are littoral in habit, their station varying from half-tide to well below lowest tide mark; they may be on exposed rocks upon which the surf breaks or under stones in sheltered pools. The larger number of species shelter on the bottom rock of a pile of stones situated just below lowest tide mark.

Hard rock with fairly smooth faces are preferred to rough or gritty rocks, thus sandstone or limestone, unless of unusual hardness, are unfavourable to Chitons; some forms prefer to settle on sea-shells, and one genus lives on "sea grasses."

CLASSIFICATION.

Ashby's Short Key in "Taxonomic Value of Characters in the Order Polyplacophora" has received the endorsement of the leading workers in the order Polyplacophora in America, Britain, Sweden, Germany, and New Zealand. It is as follows:—

"*Short Key*" definitions of those characters in Chitons, one or more of which must be present in every generic description (if only one is present it should be adequately supported by what are termed hereunder "Minor or collateral evidence").

1. Changes in the character of the girdle attachment, such as the presence, absence, or modifications in the insertion plate or other development of the articulamentum.*

2. Modifications in the dentition of the radula.

3. The position and form of the gills (ctenidia); modifications of the body organs, which are often indicated by the structure of the shell.

4. Modifications of the sense organs.

4a. Existence of or modifications in sense organs in the valves.

4b. Major modifications of the girdle armature.

In this Monograph I have adopted the partial revision proposed by the writer in various published papers. Pilsbry (Man. Conch., xiv,

* Ashby in "Acanthoid Chitons of New Zealand" (Proc. Mal. Soc. Lond., xvii, p. 9, 1926) says: "The hypothesis that the modifications in the insertion plates of *Polyplacophora* are due to the influence of ecological conditions over vast periods of time, and that these characters give us the best guide to the species' proper place in the Natural Taxis, is increasingly substantiated the more I study this group of Mollusca. One is therefore the more willing to place confidence in those divisions that are based on such features."

p. xxiii, 1892) states : " It is commonly known that the Palaeozoic Chitons are, without exception, destitute of insertion plates, and belong therefore to the family Lepidopleuridae." In 1900 Pilsbry, in Zittle, proposed the suborder Eoplacophora for the reception of these Palaeozoic forms, pointing out that the link connecting these with the most primitive group of living Chitons had not yet been discovered. The discovery in the Balcombian beds in the Tertiary deposits in the State of Victoria (Australia) of the end and median valves of *Protochiton granulosus* Ashby & Torr, obviously supplies a missing link between the Palaeozoic and one group of living forms. *Protochiton*, although without insertion plates, is undoubtedly related to the living Acanthoid group of Chitons, and on the other hand the tail valve of *Chiton gemmatus* de Koninck, from the Carboniferous beds of Dunfermline, Scotland, is in the peculiar character of the outward extension of the tegmentum, absence of insertion plate, and general shape almost its prototype, the only material difference being that in *Protochiton* the sutural laminae are widened and extended somewhat down the side of the valve ; there is no known living species that has these characters.

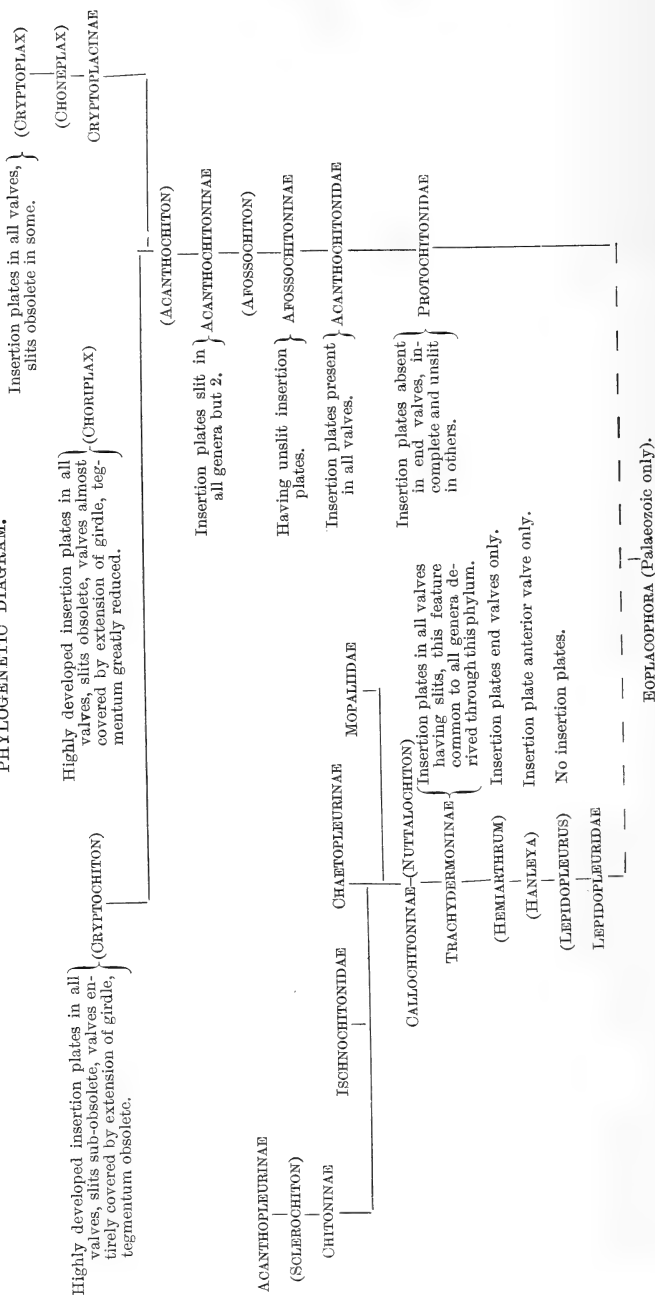
It is also quite evident that *Protochiton* is unrelated to any member of the Lepidopleuridae. This necessitates a partial revision of our previous conception of the classification of Chitons.

We must now conclude that living forms came down from Palaeozoic stock along two or more separate groups or races, developing along parallel lines, as in the diagram on following page. Dr. Thiele's discovery that, assembled under the family Lepidopleuridae, there are several species with dissimilar radula, although the absence of insertion plates is common to all, undoubtedly supports this conception.

I wish to express my thanks to all who have assisted me in the preparation of this work by the loan of material, and make special mention of the following : The Trustees and the Keeper of the Conchological Collections of the British Museum, Mr. G. C. Robson, M.A.; the Trustees and the Curator Dr. Paul Bartsch, Curator of the Division of Marine Invertebrates, United States National Museum, Washington ; the Trustees of the Oxford Museum, England ; the Director and Dr. K. H. Barnard of the South African Museum ; Mr. John Hewitt, Director of the Albany Museum ; Dr. E. Warren, Director of the Natal Museum ; the Director of the Transvaal Museum.

A check list is supplied at the end of this paper giving added information in respect to classification.

PHYLOGENETIC DIAGRAM.



NEED FOR SPECIALISED WORK IN SOUTH AFRICAN CHITONS.

E. A. Smith stated in 1903 "That until the year 1848, when Dr. F. Krauss published his work on 'The Mollusca of South Africa,' the fauna of that region had not received special attention." In 1874 Dr. E. von Martens listed a collection made by Dr. G. Fritsch. In 1892 G. B. Sowerby published a Catalogue of "Marine Shells of South Africa." E. A. Smith published an Appendix thereto in 1903. Sykes, in 1894, published a short paper on "South African Polyplacophora." Dr. Paul Bartsch published a description of Chitons in the "Turton Collection," 1915; and Ashby, in 1928, described additional material collected by Col. Turton at Port Alfred, South Africa. As regards the Polyplacophora, the papers referred to above were useful but fragmentary.*

SUBORDER PROTOCHITONINA.

Family ACANTHOCHITONIDAE.

Subfamily ACANTHOCHITONINAE.

Acanthochiton garnoti (Blainville).

(Pl. I, figs. 1-4.)

Chiton garnoti, Blainville, Dict. Sci. Nat., xxxvi, p. 552, 1825; Quoy and Gaimard, Voy. de l'Astrol. Zool., iii, p. 401, pl. lxxiii, figs. 9-14; Krauss, Die Südafrik. Moll., p. 42. *Chiton danielli*, Sowerby, Conch. Illust., p. 7, fig. 45. *Acanthochites garnoti*, Pilsbry, Man. Conch., xv, p. 14, 1892; Thiele, Rev. Syst. Chit., p. 44, 1909. *Acanthochiton garnoti*, Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 78, 1928.

A large series of this shell is before me from False Bay, Table Bay, Port Elizabeth, Port Alfred, and Kasouga (Bathurst District). The variability in the sculpture is very great, not only in different examples but also in the median valves of the same specimen. This shell seems particularly subject to erosion. The dorsal area, when present, is longitudinally grooved; in many examples the sculpture abutting on this area consists of very elongate flat granules, which are replaced towards the girdle with circular, raised granules, whereas in other examples only the circular form of granule is present, in some they are convex, in others almost flat. These variations do not justify specific separation unless they represent geographical races,

* The author omits the important paper of Nierstrasz, Zool. Jahrb., xxiii, 1906.

which I do not think is the case. This species is very near the Australian species known as *A. bednalli* Pilsbry, but is more robust, more coarsely spiculate, and more variable in the character of its sculpture. The example measured is 25×15 mm., the anterior valve has 5 slits; median valves and tail valve, slits 1/1. Angle of divergence, 105° .

The following description is copied from Pilsbry (*loc. cit.*) and needs no addition beyond the foregoing notes.

Description.—"Shell elongated, rather depressed, not carinated. Brownish with two slightly diverging whitish stripes bounding the dorsal area. The median valves are rather beaked when not eroded. The tegmentum varies on different valves from subpentagonal to subquadrangular. Latero-pleural areas closely and evenly covered with elongate granules. Dorsal areas triangular, rather wide in front, not sharply defined at the sides, closely striated longitudinally, the striae coarser at the sides and becoming transformed into granulation of the side areas. Posterior valve small, the tegmentum broader than long. Posterior sinus shallow, with a slight lobe and on each side a slit. Mucro behind the middle. Interior a rather dark blue green, the cavity and the central callus of each valve purple brown. Sinus wide and rounded; sutural laminae very large, well rounded at their anterior extremities, about equal in area to the tegmentum, side slits inconspicuous, posterior. Girdle dirty green, closely covered with clear or dark green bristles, white at the periphery, and having eighteen bunches of numerous, radiating bristles, which are dirty green, hyaline, very brittle, and over 2 mm. in length."

Acanthochiton turtoni Ashby.

(Pl. I, fig. 5; Pl. II, figs. 6-8.)

A. turtoni, Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 79, pl. vi, figs. 1-4, 1928.

General Appearance.—Elongate, carinate, beaked; dorsal area longitudinally grooved, latero-pleural areas decorated with widely spaced, squamose granules; hair tufts very marked; spicules long, glassy, and slender, those of girdle-fringe being similar, the rest of girdle clothed with shorter spicules. Colour of holotype "La France Pink" (Ridgway, pl. i), though slightly darker and duller; girdle brown.

Head Valve.—Elevated, having 5 ray-folds or shallow ribs, whole surface decorated with narrowly spaced, flat, ovate granules, the

arrangement is irregular, but somewhat concentric ; these grains are small at the apex of valve and increase in size rapidly towards the girdle.

Median Valve.—Elevated, strongly beaked, side slope straight ; dorsal area broadly wedge shaped, deeply longitudinally grooved, ribs minutely granulose towards beak ; latero-pleural area decorated by sinuate, longitudinal rows of flat, ovate granules, the grains are narrowly separated in the rows, but the space between the rows is a little broader ; as the granules correspond fairly well with those in the preceding row, a partial system of transverse sculpture is present, the grains commence small at the beak and increase in size outwardly and also along the margin of dorsal area ; there is a distinct diagonal fold corresponding with the slit.

Tail Valve.—Elevated, medium size, mucro well defined at the posterior third, slope behind the mucro steep, in some examples slightly concave ; dorsal area defined similar to median valves, balance of anterior sculpture similar to pleural area ; portion behind the mucro—granules more circular, convex, and crowded than is the case in lateral areas, with a tendency in some examples to produce extra large grains bordering the girdle.

Inside (articulamentum).—Translucent white, polished and pearly, with in places the pink tegmentum showing through ; insertion plate, upper side brown. Head valve, slits 5 ; tail and median valves, slits 1/1. Sutural laminae medium in size, sinus wide.

Girdle.—Hair tufts very marked, spicules long, glassy, and slender, furnished with a girdle-fringe of the same character, the rest of the girdle densely clothed with shorter spicules, often broken and filled in with minute sand grains.

Measurements.—The largest dry, 15×7 mm. The holotype head valve, 2.75×2 mm. ; median valve, 3.2×2.5 mm. ; tail valve, 2.9×1.5 mm. Angle of divergence, 105° .

Comparisons.—The shell of *A. garnoti* is low and arched, whereas in *A. turtoni* it is rather strongly raised and subcarinated ; the grains in *A. garnoti* are more closely packed, and the shape of the tail valve is markedly different ; the girdle in *A. turtoni*, as compared with *garnoti*, is narrow, and the spicules other than the hair tufts inconspicuous.

Habitat.—Those referred to in the type description and two sent from the Oxford Museum, No. 1050, are all from Port Alfred and were collected by Col. Turton ; the largest is in the Oxford Museum Collection ; in it the girdle-fringe is more spiculose than in any of the others.

Acanthochiton turtoni var. *tenuigranosus* nov.

(Pl. II, fig. 13.)

One example from the Oxford Museum (No. 1051) and one median valve (No. 1052). The former is dry and curled, and also came from Port Alfred, and in the shape of the valves and in the sculpture of the dorsal areas is similar to *A. turtoni*, but in the sculpture of the latero-pleural area is distinct; the granules here are much more closely packed, although the spaces between the rows are wider and the grains themselves are narrower and less raised; the colour is chestnut brown. With the limited material before me I do not feel justified in giving to this undoubtedly nearly allied form a specific name, but prefer for the present to distinguish it as a variety only.

Notoplax productus (Pilsbry).

(Pl. I, figs. 9-12.)

Spongiochiton productus, Pilsbry, Man. Conch., xiv, p. 26, 1892; *Acanthochites (Loboplax) carpenteri*, Pilsbry, Man. Conch., xv, p. 35, 1893; *Onithochiton? isipingoensis*, Sykes, Proc. Mal. Soc. Lond., iv, p. 259, text-figs., 1901; *Acanthochiton variegatus*, Nierstrasz, Zool. Jahrb. Syst., xxiii, p. 487, 1906. Iredale considers *S. productus* and *A. carpenteri* conspecific, Proc. Mal. Soc. Lond., ix, p. 100, 1910. *Spongiochiton productus*, Thiele, Rev. Syst. Chitonen, p. 36, pl. v, figs. 4-7, 1909; *A. variegatus* and *Notoplax carpenteri*, Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, 1928.

There are two examples in the material before me, one the property of the Transvaal Museum (No. 759) and labelled *Acanthochiton variegatus* Nierstrasz, and the other the property of U.S. Nat. Museum (No. 250605), labelled *Acanthochites carpenteri* Pilsbry.

Both specimens are, in my opinion, the same species, although the "hair tufts" are not visible in No. 759, but are clearly seen in No. 250605. I have disarticulated the example from the Transvaal Museum, and the following is its description.

General Appearance.—Girdle about double the width in front that it is behind, shell not carinated but flatly arched, dorsal area broadly wedge shaped, much worn but many cuneiform gashes in places; sculpture of rest of valves coarse pebble-like grains, girdle felty, no hair tufts showing, yellowish white, the shell is pink merging into pale buff.

Head Valve.—Flat, tegmentum very reduced as compared with the

articulamentum, radial ribs not perceivable, but in the other example they are suggested in the enlargement of the pebble-like grains; sculpture composed of large, irregular to lozenge shape, highly raised, pebble-like, convex grains, most of which are anteriorly elongate and some pointed, colour pink merging to pale buff.

Median Valve.—The shape of this valve varies greatly. In valve 2 the tegmentum is longitudinally the same as in the other valves but laterally much compressed, and the sutural laminae are in this valve produced forward and not outwards. The following is the description of valve 5: valve flat, dorsal area well defined, slightly depressed on either side, forming a shallow trough separating the low ridge from the pleural area, the only sculpture of this area are irregular, cuneiform pits or gashes; pleural area beset with large, pebble-like grains, most elliptical and convex, the lateral area is ill defined but slightly raised and the grains are twice as long as they are in the pleural area. Valve 6 has the trough of the dorsal area highly developed, and it was probably this feature that Sykes intended to depict in his figure of *O. isipingoensis*.

Tail Valve.—Mucro defined, appears posterior if viewed from above, but if horizontally median, the slope behind almost vertical; dorsal area defined, broadly wedge shaped, smooth except for a few pits; pleural area similar to other valves except some grains are longitudinally confluent with corresponding groove each side; area behind mucro, grains narrow and elongate, placed radially.

Inside (articulamentum).—Head valve—interior white, insertion plate broader than tegmentum, slits 5, well defined, and grooves carried to the tegmentum; teeth sharp, smooth, except for few scratches, without eaves. Median valve—slits 1/1, sutural laminae extended laterally (except in valve 2), jugal sinus broad, colour pink at beak, fading to white. Tail valve—sutural laminae extending laterally, shallow anteriorly; jugal sinus broad; slits 4, grooved to the tegmentum; insertion plate almost vertical, 2 mm. broad.

Girdle.—Very broad, when dry and curled 5 mm. wide, felty, encroaches at the sutures, hair tufts are in this example obsolete or sub-obsolete, present in other example where the spicules are short and stout, mostly broken off short. This example also possesses a girdle-fringe of similar spicules much broken; the girdle is clothed with minute arenaceous scales.

Measurements.—Example dry and much curled, width over all 14 mm. Following curvature of animal; tegmentum 8.5 mm. in width, and girdle 5 mm. either side—that is, the girdle occupies

10 mm. of total width and the tegmentum 8.5 mm. Angle of divergence about 130° .

Habitat.—Transvaal Museum (No. 759) is labelled Jeffrey's Bay, St. Francis Bay; the U.S.N. Museum (No. 250605) is from Port Alfred, and was collected by Lieut.-Col. Turton. The example figured by Pilsbry as *carpenteri* came from Port Elizabeth; Sykes' example came from Isipingo.

In conclusion.—The name *Spongiochiton* was proposed in MS. only by Carpenter, listed by Dall in 1873, and published with Carpenter's MS. definition by Pilsbry in 1892 under the ISCHNOCHITONINAE. In 1893 Pilsbry published a figure under the name *Acanthochites carpenteri*, pointing out that it belonged to Dall's subgenus *Macandrellus*, a name that Ashby has shown must be replaced by *Loboplax* Pilsbry. These genera cannot seemingly be valued higher than subgenera, and in face of the very limited material I prefer to attach the generic name *Notoplax* only. I would point out that *N. productus* has characters in common with some New Zealand Chitons for which I proposed the subgeneric name *Amblyplax*, and some allied forms have by some writers been placed with doubtful justification under the genus *Craspedochiton*. If on further study these groups are found to be con-subgeneric, the name *Spongiochiton* would antedate the others.

Subfamily CRYPTOPLACINAE Thiele.

Cryptoplax sykesi Thiele.

Cryptoplax sykesi, Thiele, Rev. Syst. Chitonen, i, p. 53, pl. vi, figs. 83–86, 1909; *C. striatus*, Sykes (non Lamarck), Journ. Mal., vii, p. 164, figs. 2–5.

Sykes figures 8 valves touching one another. Thiele only figured

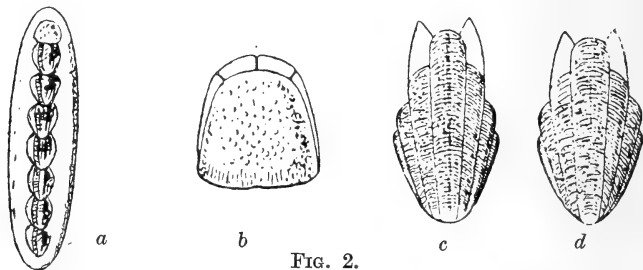


FIG. 2.

the tail valve. Locality: Natal. I have seen no example. The following is Sykes' description:

"The girdle shows no signs of pores, but is densely clothed with small spicules, forming bunches at the sutures.

"The valves, partly covered by the girdle, are all in contact and have no intervening area. The head valve is granulose, while the other valves have an almost smooth central area, and the lateral and median areas are sculptured with bold, slightly granulose ridges, this sculpture becoming more obsolete and the ridges breaking into granules as we proceed from the tail to the head valve. On comparing this species with young specimens of *C. striatus* Lamk. I have been unable to find specific characters sufficient to justify the description of it as distinct."

Habitat.—Umkomaas, in Natal; collected by Mr. Burnup, a single specimen. Measured about 14 mm. curled and dry.

Cryptoplax dupuisi n. sp.

(Pl. II, figs. 14, 15.)

Introduction.—In the collection of exotic Chitons given to the writer by Major Paul Dupuis, now Conchologist of the Musée Royal d'Histoire Naturelle de Belgique, are two examples of a *Cryptoplax* from Madagascar. These differ from *C. burrowi* Smith, and from Sykes' figures and description of *C. sykesi* Thiele. While Madagascar proper is outside the range of this paper, this species may well occur in Natal, and although seemingly so distinct from *C. sykesi*, may possibly be the senile form of that shell.

Holotype in Ashby collection; paratype in collection of South African Museum.

General Appearance.—In dried example valves 1, 2, and 3 imbricate, space between 3 and 4 is 1.5 mm.; between 4 and 5, 7 mm.; between 5 and 6, 10.5 mm.; between 6 and 7, 14 mm.; between 7 and 8, 4 mm. The first four valves are horn colour, with some wide, pale ray markings on head valve, the girdle densely covered by adpressed, flat, translucent spicules; colour buffy brown (Ridgway, pl. xl).

Head Valve.—Raised, smooth except for 4 deep, concentric growth grooves.

Median Valves.—Valve 2—almost circular, carinated; dorsal area smooth, narrow, beaked; a little irregular granulose ridging next dorsal ridge, rest of valve smooth except for deep, irregular, concentric growth grooves. Valve 3—dorsal area similar to valve 2, rest of valve decorated with widely spaced, jagged, longitudinal grooves.

Valve 4—dorsal area sub-obsolete in anterior half, rest of valve as in valve 3. Valves 5 and 6—similar to valve 4. Valve 7—keeled, raised, dorsal area narrow, smooth, and beaked, each side possesses 5 irregular, jagged, longitudinal grooves.

Tail Valve.—Shuttle shape, strongly elevated and carinated, dorsal ridge very narrow and broken posteriorly, each side 7 deep, longitudinal, wavy grooves; mucro posterior.

Girdle.—Buffy brown, the anterior portion as far as valve 4 blackish brown; densely clothed with adpressed, flat, translucent spicules, a feature it has in common with *C. michelseni* Thiele, of which *C. hartmeyer* is a synonym, very distinct from *C. striatus* Lamk. and most other species.

Measurements.—The whole animal curled and dry is 47×14 mm. Example not disarticulated, exposed portions of valves only given. Head valve, 5×5 mm.; valve 4, 4×1.5 mm.; valves 5 and 6, 2.5×1.5 mm.; valve 7, 6×3.5 mm.; tail valve (example No. 2), 6×3 mm.; elevation of tegmentum, 2.5 mm.

Habitat.—Madagascar.

Comparisons.—Differs from *C. sykesi* in that the sculpture is not regular as shown in his figure; also the dorsal area is narrow not broadly wedge shaped, as shown in Sykes' figure of *C. sykesi*; differs from *C. burrowi* in not having granulated sculpture in the head valve and in possessing a much larger, strongly raised tail valve, and differs from *C. michelseni* (syn. *hartmeyer*) in the absence of the granulated sculpture of the head valve and in the absence of the small spicules which in Thiele's shell separate the larger, flat, adpressed spicules from one another.

Note.—It must be remembered that in most, if not all, the members of this genus the juvenile form is very diverse from the adult (leading in some cases to the description of the juvenile as a different species). Thus, in the juvenile all the valves are imbricate, however far they are separated in the adult or senile form; the valves in the very juvenile are broad in proportion to length, and in this stage simulate those of an *Acanthochiton*; in the next stage the valves increase longitudinally and not laterally, then appearing long and narrow; in most, if not all, species up to this stage the sculpture is granulose, but in many species the method of sculpture abruptly changes from granulose to that of coarse longitudinal ribs or ridges, at which stage the additions to the shell almost cease and the growth of the body and girdle in time separate, some, usually the last four valves, sometimes quite widely. It seems hardly likely that *C. sykesi*, which

measured 14 mm. in length when dry, could be the juvenile form of the one above described under the name *C. dupuisi*, but this possibility, although seemingly remote, must be kept in view when new material is available.

SUBORDER LEPIDOPLEURINA.

Family LEPIDOPLEURIDAE.

Lepidopleurus sykesi (Sowerby).

(Pl. II, figs. 16-19.)

Chiton (Hanleya) sykesi, Sowerby, Mar. Invest. S. Africa, ii, p. 225, pl. v, fig. 13, 1903.

General Appearance.—Colour, pale straw colour except where valve is overlapped by valve in front, this portion is white; shell much raised, arched not keeled, sculpture consists of closely packed, minute grains arranged in longitudinal rows in dorsal-pleural area, partly radial in lateral area, some deep, concentric growth grooves present in most valves; girdle narrow, clothed with short, glassy spicules.

Head Valve.—Laterally wide, raised, decorated (under 20 mag.) with closely packed, radiating rows of minute grains; (under 65 mag.) these grains are seen to be circular, convex, and mostly separated; there is no sign of coalescing; towards the outer margin there are several deep, concentric growth grooves.

Median Valve.—Shell highly raised, arched, dorsal-pleural area inseparable, decorated with longitudinal rows of minute, flattened granules a little larger than those in anterior valve; those on the jugum are smaller and show a tendency to coalesce, but the grains increase in size towards the girdle. The lateral areas are raised, sculpture only very slightly radial, granules towards girdle slightly larger than pleural area, several concentric growth grooves are present of which the outer three are very deep; valve 4 is used in this description, the side slope is steep and convex.

Tail Valve.—Large and laterally wide, raised, mucro well defined, median slope immediately behind mucro steep, almost vertical, then extending outwards in a straight slope; in front of mucro sculpture similar to that of pleural area in median valves; mucro itself and immediately behind smooth, posterior portion similar to head valve but without any distinct radial arrangement, several deep, concentric, growth grooves are present.

Inside (articulamentum).—White, all valves without insertion plates; but the head valve possesses a very interesting feature in that, commencing at the suture and continuing on either side for about 1 mm., the articulamentum has extended forward, these two small, shallow, protruding plates, equal to about two-sevenths of the periphery, are evidently the beginnings of what will ultimately develop into an insertion plate; sutural laminae weak, produced forward; tegmentum slightly bowed outwards in the jugal sinus, which is very broad; a callus joins the bases of the laminae.

Girdle.—Narrow, densely clothed with white spicules, of these the most numerous are short and stout, $64\ \mu$ in length, fringe spicules $137\ \mu$ long, and some very slender spicules $162\ \mu$ long, some longer.

Measurements.—The whole shell too curled to measure; head valve, 6×3 mm.; valve 4, 7×3.5 mm.; tail valve, 6×4 mm.; angle of divergence, 90° .

Habitat.—The localities of the specimens in the South African Museum are as follows: Cape Point E. 26 miles, 210 fathoms. Type. Lion's Head S. 82° E. 27 miles, 125 fathoms, and N. 67° E. 25 miles, 131 fathoms. Vasco da Gama Peak S. 75° E. 13 miles, 166 fathoms, and N. 71° E. 18 miles, 230 fathoms. South Head E. \times S. $\frac{1}{2}$ S. 25 miles, 190 fathoms. (All localities are off the Cape Peninsula.)

Conclusion.—In the absence of insertion plate in any of the valves this cannot be placed in the genus *Hanleya*, but it may be considered an advanced member of the genus *Lepidopleurus*. The genus *Hanleya* possesses an insertion plate in the head valve only, whereas the genus *Lepidopleurus* is without insertion plate in all valves.

SUBORDER CHITONINA Thiele.

Family CALLOCHITONIDAE Thiele.

Subfamily TRACHYDERMONINAE Thiele.

Trachydermon (*Craspedochilus*) *turtoni* Ashby.

(Pl. II, figs. 20–23.)

T. (C.) turtoni, Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 80, pl. vi, figs. 5–8, 1928.

General Appearance.—Broad, bluntly carinated, side slope a little curved, beaked, ground colour ivory white blotched with brown. The dorsal ridge in valves 2–7 is “sayal brown” (Ridgway, pl. xxix), a white spot on the anterior portion of the dorsal area of valves

2-4. The head valve is freely blotched with a darker shade of brown, and similar, though mostly paler, spots are scattered widely over the rest of shell. The girdle is creamy white, irregularly banded with pale brown.

Head Valve.—Broad, elevation medium, under pocket lens apparently smooth, but under 65 mag. is seen to be minutely radially striate, the striae being close together and the ridges between being barely $12\ \mu$ in width where measured near the girdle. Under a lens of 20 mag. these radial striae are only just visible; while there are no defined radial ribs other than these minute ones, there is evidence of broad, very shallow, ill-defined radial undulations, the presence of which should be more apparent in a larger example.

Median Valve.—Laterally broad, longitudinally narrow, elevated, carinated, side slope convex; dorsal area defined, bluntly beaked, and the whole area under 65 mag. decorated with longitudinal striae, which are more widely spaced than is the case with the ornamentation in other parts of the shell, and are crossed transversely by numerous growth striae, giving to these minute, longitudinal ridges a granulose appearance. The pleural area under the same magnification is seen to be minutely granulose, due to the continuation of the closely packed, transverse growth lines across faint longitudinal ridging. The lateral area is slightly raised, with similar sculpture to the pleural except that here the direction of the minute ribbing is radial.

Tail Valve.—Dorsal and pleural areas indistinguishable, minute sculpture similar to other valves except that the longitudinal grooving is less defined but the transverse striae are stronger; mucro well defined, anterior of centre, slope immediately behind is at first steep, then becoming flatter, the minute sculpture on this part of valve is radial, crossed towards the outer edge by growth lines.

Inside (articulamentum).—White, teeth sharp; slits in head valve probably 10; median valve, 1/1; tail valve, 7; eaves spongy and in median valves much thickened at slit, the perforations in the spongy eaves are very large near the insertion plate but smaller towards the tegmentum; in the tail valve the perforations measure $20\ \mu$ to $25\ \mu$; sutural laminae well defined and jugal sinus very broad.

Girdle.—The girdle is damaged, is creamy white irregularly banded with pale brown, sprinkled over the brownish portions are a number of minute black "grains" that give a greyish tone to the brown. The girdle is densely covered with irregular, arenaceous scales, very similar, though smaller, to the girdle scales of *T. (C.) cinereus* L.; there

is a well-defined girdle-fringe composed of long, very slender, glassy spicules.

Measurements.—The whole shell dry, except tail valve, which was detached, 5×3.5 mm., but as girdle was curled have quoted 5×4 mm.; head valve, 2.5×1 mm.; median valve, 3.3×1.5 mm.; tail valve, 2.25×1.25 mm.; girdle spicules (three measured), 162μ , 175μ , 225μ respectively in length, in thickness tapering from 25μ to 12μ . Scales so irregular that it is difficult to determine their diameter; it is about 12μ . Quite a large number of these have what looks like a pigmented nucleus; this dark spot is a distinct circular pit, with a shining, black substance at the base, the pits are about 3μ in diameter and may be terminals of nerve fibres, and correspond with the micropores of the tegmentum, but its occurrence in minute girdle scales is, I believe, quite a new discovery. Angle of divergence, 90° .

Habitat.—Port Alfred, South Africa. Body, with radula, had been removed.

Note.—The suggestion made by Iredale in 1914, that *Lepidochiton* should replace *Craspedochilus* Sars., I have not adopted, as it requires additional investigation.

Subfamily CALLOCHITONINAE Thiele.

Genus *Callochiton* Gray.

Subgenus *Trachyradsia* Dall., syn. *Stereochiton* Dall.,
syn. *Eudoxoplax* Iredale & May.

Callochiton (*Trachyradsia*) *castaneus* (Wood).

(Pl. II, fig. 24; Pl. III, figs. 25–27.)

Chiton castaneus, Wood, Gen. Conch., p. 13, pl. ii, figs. 2–3; pl. iii, figs. 2–3, 1815; Sowerby, Conch., iii, fig. 114; Reeve, Conch. Icon., pl. v, fig. 25. *C. cerasinus* Chemn., Reeve, Conch. Icon., fig. 63; *C. bicolor* Spengler, 1797, non Gmelin, 1791; ? *C. fulgetrum*, Reeve, loc. cit., pl. xiii, fig. 71, 1847; ? *C. dentatus*, Spengler, Skriv. Nat. Sels., v, 4, p. 88, 1797 (if *C. dentatus* Spengler, 1797, is *C. castaneus* Wood, it would antedate Wood's name); *C. planatus* Spengler, loc. cit., p. 91; *C. fulgetrum* Reeve is considered by Sykes, Proc. Mal. Soc. Lond., i, pt. 3, p. 32, 1894, as conspecific with *C. castaneus* Wood; *Callochiton* (*Stereochiton*) *castaneus*, Pilsbry, Man. Conch., xiv, p. 52; *C. (T.) castaneus*, Thiele, loc. cit., p. 108; *Eudoxochiton castaneus*,

Ashby, *loc. cit.*, p. 89; *Callochiton* (*Trachyradsia*) *castaneus*, Ashby and Cotton, Trans. Roy. Soc. S. Austr., 1930, not *C. castaneus* Quoy and Gaimard, nor *C. castaneus* Couth.

Note.—Older references extracted from Pilsbry, Man. Conch.

General Appearance.—Two from Table Bay, S.A. Mus., No. 4872, colour burnt sienna (Ridgway, pl. ii), with, in the smaller example (12×7.5 mm. dry) towards the girdle on each valve, a pale yellow blotch; two S.A. Mus., Nos. 4875, 4881, the larger (41×27 mm. curled and dry), beautifully mottled and streaked with yellow, pinkish buff, and chocolate; two specimens from Port Alfred, U.S. Nat. Mus., labelled *Ischnochiton Crawfordi*, No. 249828, one liver colour and bright pink inside, the other liver colour in end valves only. Shell broad, flat, and carinated, sculpture minutely decussate; girdle clothed with shuttle-shaped or broadly needle-shaped scales, which are often detached.

Head Valve.—Flat, laterally very broad, anteriorly very short, decorated under 20 mag. evenly with minute decussate pattern, under 65 mag. is seen the minute, parallel scratching common to members of this genus, and also "eye-dots" easily seen under this power in all valves.

Median Valve.—Flat, carinated, laterally broad, anteriorly short, side slope low and straight, sculpture similar to the anterior valve, lateral area slightly raised, eye-dots numerous in this area situated in defined pits, the eyes are 25μ in diameter.

Tail Valve.—Wide, flat, carinated, mucro slightly anterior of median, sculpture similar to other valves, posterior slope slightly convex.

Girdle.—Wide and capable of great expansion, densely clothed with "needle-like" scales, which in their exposed parts measure $112 \times 25 \mu$. Thiele (*loc. cit.*), p. 106, quotes Nierstrasz (Zool. Jahrb. Syst., v, p. 23), that the needles of *C. castaneus* Wood have an entirely different shape from those of typical *Callochitons*. I disagree with this statement; both the girdle scales and the radula of this species are quite typical of the genus *Callochiton*.

Inside (articulamentum).—Colour, white shading to pink at apex and towards margin of valves, in some nearly all pink. Head valve—insertion plate well produced, slits 22, teeth very irregular, with irregular, rounded edge, partially propped; eaves spongy, overhanging but little. Median valve—slits $4/4$, teeth and eaves similar to head valve; sutural laminae shallow but extended laterally and joined across the middle line, jugal sinus a mere indentation in the

articulamentum. Tail valve—slits 18, insertion plate and sutural laminae similar to other valves.

Measurements.—Head valve, 8×3 mm.; median valve, 9.5×4.5 mm.; tail valve, 7.5×4.5 mm. Angle of divergence, 125° .

Note.—Ashby, without seeing a specimen, listed this species as a *Eudoxochiton* in his paper describing the Turton Collection, because of its similarity in published figures with the Australian *Eudoxoplax inornatus* Ten. Woods; and because May considered *Eudoxoplax* a subgenus of *Eudoxochiton*. Having since examined a juvenile *E. inornatus*, he found it a true *Callochiton*, and Ashby and Cotton have placed it in the section *Trachyradsia*.

Family MOPALIIDAE Pilsbry.

Plaxiphora simplex Haddon.

(Pl. III, figs. 28–31.)

P. simplex, Haddon, Challenger Expt., Polyplacophora, xv, p. 33, pl. iii, figs. 13 a–c, 1886; Pilsbry, Man. Conch., xiv, p. 320, pl. lxvii, figs. 43–46, 1892.

Introduction.—Dr. Barnard of the South African Museum has forwarded to me two examples of a *Plaxiphora* from Tristan da Cunha, with the request that I would include a description in this paper; although the locality is extra-limital I am glad to comply with the request. These two examples are too eroded to allow of a full description; I therefore transcribe Haddon's type description, adding notes on the two examples now before me.

Haddon's Description (Haddon also includes Carpenter's MS. description, but furnishes a better one of his own):—

"Shell smooth, simply marked with lines of growth, flat sides meeting at a variable angle. *Anterior valve*—small, surface smooth. Under surface with 8 slits, teeth fairly long, smooth, and sharp; eaves short. *Intermediate valve*—central area smooth, flat. Lateral areas inconspicuous, with two or three very faint radiating ridges. Under surface with a median horizontal rib-like swelling, sutural laminae broad but not deep; jugal sinus wide and shallow; one lateral slit; eaves short. *Posterior valve*—very small and flat, greatly corroded; umbo apparently flat and terminal; posterior border thickened. Under surface—sutural laminae as in intermediate valves, but the jugal sinus is comparatively narrow and deep; slits and teeth absent; posterior border much swollen. *Girdle*—very

thick and fleshy, upper surface having a spongy appearance owing to being beset with very short, horny spines, which are scarcely raised above the surface; there are tufts of longer spines, three to nine in each tuft, opposite the sutures of the valves; these have no definite position round the anterior valve. Situated outside these are numerous scattered similar tufts, usually somewhat smaller in size, which pass into an imperfect peripheral fringe of spines."

In the two examples before me the tegmentum has been eroded, except the narrow strip protected by the overlapping valves and at the sides at the girdle; the only sculpture visible is narrow growth grooving parallel with the margin of shell, but in the anterior valve there is some evidence of broad ray-ribbing or folding.

Inside.—Pale blue, eaves slightly spongy and overhung, but insertion plate extends beyond; teeth straight edged and fairly sharp, slits broad; head valve 8, median valve 1/1, tail valve unslit, without true insertion plate, the articulamentum being thickened at the edge. Sutural laminae well produced, straight along front line, sinus between wide in median valves and almost joined across the median line by a shallow extension of the articulamentum; in tail valve the jugal sinus is narrower and the laminae do not join across the median line; in all valves the tegmentum is bowed outwards in the jugal sinus.

Girdle.—The "short horny spines which are scarcely raised above the surface," mentioned in Haddon's type description, are short, blunt spicules or elongate scales (either term can be used), the one measured was $75\ \mu$ long and $25\ \mu$ wide; these are packed so closely together that only the rounded ends are visible, and give the spongy appearance mentioned by Haddon.

Measurements.—Given by Haddon: 40×27 mm., divergence 125° ; 32×18 mm., divergence 130° ; 45×25 mm.; S.A. Mus. example disarticulated. Head valve, 7.75×3.5 mm.; median valve, 10.5×5.5 mm.; tail valve, 8×4 mm.

Note.—Haddon described and figured a second species of *Plaxiphora* from Tristan da Cunha, under the name *P. carpenteri*, from a single very juvenile costate example, 14×9 mm. I would point out the possibility that there is only one variable species represented in that island. In Australia, along the coasts of Victoria, South Australia, Tasmania, and Western Australia, we have a costate form and a non-costate form living together in most places in varying proportions according to the localities. It appears there are intermediate forms between these, and although three names at least have been proposed

for special forms, we believe they will prove to be representatives of one very variable species. Also be it noted that in the juvenile stage the costate sculpture is usually much stronger.

Haddon states that of the four examples the two larger were dredged in 100 and 150 fathoms respectively, and the two smaller were shore shells. In Australia this species is essentially littoral in habitat. The set in the South African Museum were collected on the shore.

Family ISCHNOCHITONIDAE Pilsbry.

Subfamily CHAETOPLEURINAE Thiele.

Chaetopleura papilio (Spengler).

(Pl. III, figs. 32, 33.)

Chiton papilio, Spengler, Skriv. Nat. Sels., p. 86, 1797; *C. castaneus*, Quoy and Gaimard (not Wood), Zool. Voy. d'Astrol., p. 387, pl. lxxiv, fig. 33; *C. watsoni*, Sowerby, Mag. Nat. Hist., p. 288, 1840; Conch. Illust., figs. 81, 82, 130. *C. papilio*, Krauss, Die Südafrik. Moll., p. 41, 1848; Reeve, Conch. Icon., pl. vi, fig. 32 (*a, b*). *Chaetopleura watsoni*, Thiele, Das Gebiss der Schnecken, ii, p. 380, pl. xxxi, fig. 15 (dentition); *C. papilio*, Thiele, Revis. Syst. Chit., p. 74, 1909; Pilsbry, *loc. cit.*, xv, p. 72; Ashby, *loc. cit.*, p. 90; Thiele in Schultze, Forsch. Reise, iv, p. 269, 1910.

General Appearance.—Very strongly raised, slightly carinated but steeply arched; dorsal-pleural area very finely more or less longitudinally grooved; lateral areas raised, upper portion smooth, outer irregularly, finely, radially grooved, with scattered, circular pustules. Colour, vandyke brown to chocolate (Ridgeway, pl. xxviii), dorsal area darker brown edged paler.

Head Valve.—Strongly raised, upper half smooth, lower irregularly, sub-obsolete, radially grooved and decorated with irregularly spaced rows of circular, convex pustules; ground colour irregularly flecked with pale markings.

Median Valve.—The median valves vary in shape in the same example to an unusual degree. Valve 6 is the least damaged and is now described: elevated, keeled near the beak and arched anteriorly, side slope steep and slightly convex, dorsal-pleural area closely longitudinally grooved, the portion of the pleural area abutting on the lateral forms a shallow trough, over a good part of which the grooving is absent; lateral area raised, almost smooth except for

scattered, somewhat irregular, radial rows of small, circular, convex pustules, all areas crossed by growth grooves.

Tail Valve.—Raised, arched, mucro median, grooving sub-obsolete in dorsal-pleural area, portion behind mucro steep and slightly convex, most of area smooth but some faint, widely spaced grooving and scattered pustules, similar to the lateral areas, towards posterior margin.

Inside (articulamentum). — White outside and pinkish brown towards centre of all valves. Head valve badly broken, insertion plate seems well produced forward and multislit, eaves solid. Median valve —sutural laminae large, produced forward, joined across the middle line by a bilobed extension of the articulamentum, a slit on either side almost separating this process from the sutural laminae, the centre of this process in the jugal sinus is subdentate; slits 1/1. Tail valve—insertion plate narrower than that of head valve, slits 9, teeth rather blunt, irregular, and some propped and fluted, much as in the genus *Callochiton*, others only grooved, edge of teeth rounded and irregular, sutural laminae and process in jugal sinus similar to median valves.

Measurements.—Whole shell before disarticulation, dry and a little curled, 38×20 mm.; other examples up to 48×26 mm.; head valve too damaged to measure; median valve No. 6, 17.5×12 mm.; tail valve, 13×7.5 mm.; angle of divergence, 100° .

Habitat.—S.A. Mus. (Nos. 4887, 4889), Kalk Bay, False Bay. Lüderitzbucht (Thiele).

Chaetopleura pertusus (Reeve).

(Pl. III, figs. 34–36.)

Chiton pertusus, Reeve, Conch. Icon., pl. xvi, fig. 88, 1847; *C. pustulatus*, Krauss, Die Südafrik. Moll., p. 42, pl. iii, fig. 7, 1848; *Ischnochiton pertusus*, Pilsbry, Man. Conch., xiv, p. 103, pl. xx, figs. 18–19; *I. pertusus*, Carpenter MSS., quoted by Pilsbry, p. 104 (not of Reeve); *Chaetopleura pustulatus*, Pilsbry, loc. cit., xv, p. 73, pl. x, figs. 23–26, 1893; Ashby, Mal. Soc. Lond., xviii, pt. 2, p. 90, 1928; *Ischnochiton pertusus*, Ashby, *ibid.*, p. 90.

Introduction.—The following is Reeve's description of his *Chiton pertusus*: "Shell oblong ovate, valves elevated in the middle, very closely grooved throughout, ridges of the central areas thin, converging towards the umbones, interstitial grooves pricked, posterior edge of the valve serrated; dark red sprinkled with a few minute white dots, ligament horny, very sparingly beset with short bristles."

Locality.—Simons Bay, Cape of Good Hope.

Pilsbry referred *C. pertusus* Rve. to the genus *Ischnochiton* on the strength of MSS. notes of Carpenter on two examples on the Cuming Coll. Brit. Mus. It is quite evident that the examples referred to by Carpenter were not Reeve's shell at all; for Reeve stated that the girdle of his *C. pertusus* was "horny, very sparingly beset with short bristles," whereas the shell described in Carpenter's notes possessed "ischnoid scales . . . imbricating and striated." Mr. G. C. Robson has kindly sent to me for this examination the shell Carpenter described; it has, as Carpenter states, typical ischnoid girdle scales, and obviously is not the shell described by Reeve.

I propose to recognise Reeve's *C. pertusus* in *Chiton pustulatus* Krauss, for Reeve's description, figure, and locality can well be applied to that species; as *C. pertusus* Rve. antedates *C. pustulatus* Krauss, this latter name becomes a synonym of the former.

General Appearance.—The example disarticulated (S.A. Mus., No. 6766) from St. James, False Bay, is a curled and faded specimen, probably was picked up on shore and had been bleached by sunshine.

The ground colour is pinkish brown, the dorsal ridge in valve 2 is cream white, a narrow streak of same colour is present near the beak in all median valves. Shell is carinated, side slope rather steep and slightly convex, dorsal and pleural areas longitudinally ribbed with irregular bridging, which near the beak forms a complete network; lateral areas and end valves beset with scattered pustules and ray ribbed in varying degrees. Girdle leathery, beset with scattered long hairs and scattered very short, stout spicules.

Head Valve.—Raised, probably smooth at apex; in example described this is broken and worn, slope of valve almost straight (very slightly convex), steep, sculptured with shallow, irregular, broad, radiating riblets; down the centre of each riblet is a row of pyriform to circular, convex, widely spaced grains; the surface of shell, apart from this sculpture, is smooth, a few riblets bifurcate.

Median Valve.—These valves vary considerably in longitudinal measurement, slightly carinated, side slope slightly convex, becoming straight towards girdle; the dorsal area is not defined; the dorsal-pleural area is decorated with longitudinal rows of narrow, beaded, granulose riblets, the grains are widely spaced; on the umbo some of these riblets converge, the interspace between the riblets is about three times the width of the riblets themselves and is deeply and widely pitted; on the anterior third, especially towards the beak, the

riblets converge and the pits become proportionally smaller and closer together, forming a complete cellulose or network sculpture in the juvenile portion of the shell. Krauss describes the dorsal-pleural area as "longitudinally subgranose and cancellated," and the lateral area as "delicately punctulate and sparsely sculptured with elevated cylindrical pustules" (Pilsbry's translation). In some of the valves this description is complete, in others there are in the lateral area shallow ray ribs similar to the anterior valve; the small punctures referred to by Krauss are widely spaced and follow the shallow groove between the riblets where present.

Tail Valve.—Medium size, mucro slightly ante-median, raised, slope behind commencing rather steep and rapidly becoming flat, slightly concave towards the girdle. Sculpture in front of mucro completely bridged across, forming a complete network or lattice-work pattern; behind the mucro sculpture similar to head valve, except the ray-riblets are absent on portion immediately behind mucro.

Inside (articulamentum).—White with a pink blotch on either side of the beak. Head valve—insertion plate produced forward and slightly thickened at slits; slits 10, deeply cut; sinus carried to the tegmentum; teeth thick, rather blunt, with some shallow and inconspicuous groovings on upper side. Median valve—sutural laminae large and produced forward, anterior edge straight, jugal sinus medium but possessing a bilobed extension of the articulamentum which is notched on either side and finely dentate in centre; callus pronounced, tegmentum folded over at the posterior margin. Tail valve—sutural laminae shallower than in the median valves, process in the jugal sinus present but not produced beyond the tegmentum as in median valves, edge straight not bilobed; insertion plate short, very thick, slits 14 and very broad, the 2 lateral teeth on either side similar to those of head valve but the centre ones are small, the slits are widest in the centre, teeth more or less grooved and propped; the eaves in all valves overhang and are much thickened on the inside.

Girdle.—All Krauss says about the girdle is "Reddish-yellow, sparsely clothed with long brownish hairs." The example under examination seems to have been almost three times the length of the specimen described by Krauss; quoting from my notes: Girdle leathery, beset with scattered long hairs and scattered, very short, stout spicules. The other example without any date, from same museum, which I call No. 2, has scattered all over the girdle small

clusters of slender pale brown hairs, and in addition portions of the girdle are beset more closely with short, stout, pointed spicules, a large proportion of which are dark brown; the girdle surface being covered with minute, arenaceous scales through which the bunches of hairs and spicules push their way.

Measurements.—The whole shell, which was dry and curled, is estimated to have measured 38 mm. in length. Head valve, 8.5×5 mm.; median valve, 10×5.5 mm.; tail valve, 5×7.5 mm. Angle of divergence, 90° .

Habitat.—The example S.A. Mus., No. 6766, from St. James, False Bay; the other example I am placing with this species is without data. Simon's Bay (Reeve), Natal, on shore (Wahlberg), two valves from Port Alfred, U.S. Nat. Mus., No. 250622.

Chaetopleura destituta Sykes.

(Pl. IV, figs. 37–39.)

C. destituta, Sykes, Proc. Mal. Soc. Lond., v, p. 195, text-fig., 1902; Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 90, 1928.

Introduction.—In the material from the South African Museum are two examples without name or data, Nos. 4874 and 4880 respectively; * the latter has a note attached: “? *C. setiger*, idenf. J. H. Ponsonby”; both these, I am confident, may be rightly referred to Sykes' species; the following is the description of No. 4874 except where otherwise stated.

General Appearance.—Description of the larger No. 4880; shell slightly carinated but much flatter than *C. papilio*; valves beaked, dorsal-pleural area mostly smooth but showing a little longitudinal grooving on most valves, end valves and lateral areas almost unsculptured except for growth lines and a little shallow, radial ribbing and a few small pustules showing in places; the girdle is leathery, with scattered dark-coloured spines and encroaches at the sutures. Colour, No. 4880 vandyke brown; smaller disarticulated example, No. 4874, walnut brown (Ridgway, pl. xxviii).

Head Valve.—Broad and flat, without ornamentation except for shallow, broad, sub-obsolete ray-ribs.

Median Valve.—Carinated, flat; side slope shallow, convex; dorsal-pleural area showing on and near the jugum, shallow, sub-obsolete, longitudinal grooving; the portion of the pleural area abutting on the lateral area forms a shallow trough; lateral area shallowly raised;

* Probably from Sea Point, Table Bay.—EDITOR.

most of the pleural and all the lateral area is without sculpture except for shallow, concentric growth grooves.

Tail Valve.—Laterally broad and shallow, mucro median, anterior portion without sculpture except shallow growth grooves, posterior portion possessing shallow, sub-obsolete ray-ribs and growth grooves.

Inside (articulamentum).—Anterior valve broken, only 4 teeth remaining, insertion plate well produced forward, multislit, the existing 4 teeth are rather blunt and straight edged. Median valve No. 7—sutural laminae large but less produced forward than *C. papilio*, the jugal sinus possesses a spade-like extension of the articulamentum which is not bilobed as in *C. papilio*, the two lateral slits are carried to the tegmentum, also this process is more or less vertically grooved throughout. Tail valve—sutural laminae and jugal sinus similar to median valves; insertion plate narrower than head valve, is damaged, but slits have been 10; teeth irregular and those present mostly straight edged, irregularly fluted on outside.

Measurements.—The larger, No. 4880, 68×34 mm.; No. 4874, 40×25 mm. Head valve too broken to measure; median valve No. 7, 18×10 mm.; tail valve, 14.5×8.5 mm. Angle of divergence, 110° .

Conclusion.—Although the sculpture is variable and what there is approaches *C. papilio*, the form of shell seems to indicate a distinct species.

Dinoplax gigas (Gmelin).

(Pl. IV, figs. 40–42.)

Chiton gigas, Gmelin, Syst. Nat., xiii, p. 3206, 1788; Spengler, Skriv. Nat. Sels., iv, p. 101, 1795; Wood, Gen. Con., p. 12, 1814; Brugière, Ency. Meth., clxi, fig. 3; Lamarck, An. s. Vert., vii, p. 490; Blainville, Dict. Sci. Nat., xxxvi, p. 543; Reeve, Conch. Icon., fig. 65; Krauss, Die Südafrik. Moll., p. 40, pl. iii, fig. 3 (young); H. and A. Adams, Gen. Rec. Moll., p. 475; Sowerby, Marine Shells S. Africa, p. 50. *Chaetopleura gigas*, Shuttleworth, Bern. mitt., p. 67, 1853. *Acanthopleura gigas*, Gray, P.Z.S., 1847, pp. 68, 169. *Chiton sub-gigas*, Blainville, Dict. Sci. Nat., p. 543 (juvenile); *C. albus*, Barbut, Gen. Ver. of Lin., pt. 2, 1788 (not of Linn.). *Dinoplax gigas*, Pilsbry, Man. Conch., xiv, p. 254, pl. lvii, figs. 21–32, 1892; *D. fossus*, Sykes, Proc. Mal. Soc. Lond., iii, p. 277, 1899; *D. gigas alfredensis*, Bartsch, U.S. Nat. Mus. Bull., xci, 1915; Thiele, Rev. Syst. Chitonen, p. 73, 1909; Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 83.

Introduction.—This species is most variable in sculpture. Ashby

(*loc. cit.*, p. 83) discusses the extent of variation very fully and concludes the discussion in the following words. "It must be admitted that the coarsely sculptured form described by Sykes as *D. fossus* and the minutely sculptured form described by Bartsch as *D. g. alfredensis* are sufficiently different to warrant specific separation provided there existed no intermediates, or if the most diverse forms were limited to definite localities; in this last case they might have been treated as subspecies, as was done by Bartsch in his *alfredensis*, but in face of the fact that all three forms occur at Port Alfred and that a complete series of intermediates from one extreme to the other can be obtained, we cannot in my opinion do other than consider *D. fossus* Sykes and *D. gigas alfredensis* Bartsch as synonyms of *D. gigas* (Gml.), retaining these names to distinguish the respective varieties if so desired."

General Appearance.—Broad, strongly carinated, the lateral areas much raised, end valves and lateral areas decorated with numerous, broken, radial riblets, sub-obsolete in some examples; the dorsal-pleural area varying much in the strength of the ornamentation, the coarser forms showing sublongitudinal, irregular, wavy riblets crossed by transverse riblets, forming an irregular cellulose sculpture, while the smoother forms so modify this sculpture that they appear minutely decussate and in places merely punctate. The girdle in perfect examples is densely spiculose.

Head Valve.—Large and broad, decorated with numerous, closely packed, broken, radial riblets; several deep, concentric growth sulci are present; the interstices are irregularly pitted, giving a pectinate appearance to the sides of the riblets.

Median Valve.—In the example photographed, which represents var. *fossus*, valve 3 certainly has a slight beak, is strongly carinated, side slope straight, the dorsal ridge is almost smooth, the dorsal-pleural area is decorated with numerous wavy, sublongitudinal, bifurcating riblets which contract and widen in a most peculiar way, these riblets are separated from one another by deep interspaces, which are termed by Sykes in his description of *fossus* "stab-like markings." The lateral area is strongly raised and decorated with 7 ray-riblets, the interspaces are minutely granulose. The colour of the valve is silvery grey, mottled with pale brown; the beak is red.

Tail Valve.—Small as compared with other valves, carinated but flat, dorsal area raised and narrowly wedge shaped, mucro post-median; anterior to mucro, sculpture similar to dorsal-pleural area

in median valves; area posterior to mucro, sculpture similar to that of head valve, but strongly raised.

Inside (articulamentum).—White shading to grey or pink towards the apex. Head valve—insertion plate greatly thickened in senile shells, and eaves then almost absent, slits 10; teeth fairly regular, sharp edged, but grooved on outside, simulating serrated teeth. Median valve—insertion plate much thickened at slit, slit 1/1, eaves at slit. Tail valve—insertion greatly thickened, slits 10, inconspicuous, narrow, and cut on diagonal; insertion grooved, almost laminated outside; sutural laminae in median valves well produced, straight edged, joined across middle line, jugal sinus only indicated by bilateral slit, but in tail valve the sutural lamina are more produced forward, anterior edge curved outwards, jugal sinus almost completely occupied by a spade-like process, which is bowed outwards.

Girdle.—Spiculose in juvenile or well-preserved examples, densely clothed with short, mostly brown spicules measuring $90 \times 13 \mu$, also at sutures, and scattered bunches are slender spicules, and also with these and at girdle-fringe, long, stout, striate, white spicules; one measured was $560 \times 75 \mu$.

Measurements.—Senile shells roughly measured because curled, 110×50 mm.; 104×53 mm. Separate valves of senile shell No. A5333: head valve, 38×22 mm. (eroded); median valve, 40×20 mm.; tail valve, 29×16 mm. Angle of divergence, 110° . Gills extend full length of foot.

Habitat.—Port Alfred (example here figured); Kowie; Kalk Bay; Algoa Bay; Durban.

Subfamily ISCHNOCHITONINAE Pilsbry.

Ischnochiton oniscus Group.

Pilsbry (*loc. cit.*, p. 98) proposed an "*Ischnochiton textilis*" Group, but as is shown later under the heading *I. textilis* (Gray), Pilsbry was under a misconception as to the true character of Gray's species, and had concluded that it was a near ally of *I. oniscus* (Krauss), whereas it belongs to Pilsbry's group *Radsiella*. In the material placed in my hands there are four distinct species in all of which the sculpture is so alike that it is difficult to separate them on shell sculpture alone. In all the sculpture may be termed minutely decussate. But each of the four are easily distinguished by the character of the girdle scales. It must be remembered that to see these characters clearly it is necessary that the girdle scales are clean

dry, and not eroded by the action of chemicals such as formalin, the action of which is fatal to fine sculpture. The four species referred to the above group are *I. oniscus* (Krauss), *I. elizabethensis* Pilsbry, ? *I. ludwigi* (Krauss MSS.) Pilsbry, and *I. hewitti* n. sp. The identification of *I. ludwigi* from Krauss' definition is doubtful.

Ischnochiton oniscus (Krauss).

(Pl. IV, figs. 43-46.)

Chiton oniscus, Krauss, Südafrik. Moll., p. 39, pl. iii, fig. 4, 1848. *Ischnochiton oniscus*, Pilsbry, *loc. cit.*, xiv., p. 100, pl. xx, fig. 125, 1892; Sykes, Proc. Mal. Soc. Lond., i, pt. 3, p. 133, 1894; Sykes states: *I. macgillivrayi* Pilsbry (in part); and *I. viridulus* of "Challenger," not of Couthouy; *I. oniscus*, Thiele, *loc. cit.*, pp. 111, 113; Ashby, *loc. cit.*, p. 90; Sykes, Naut., xii, No. 3, p. 41, July 1898.

The following is Pilsbry's description: "The valves as well as the girdle appear smooth to the naked eye, but the lateral areas are visible. Under the lens the central areas are very finely punctate on the dorsum, and on the pleural they are longitudinally striated; these striae continue upon the lateral areas, becoming wavy striae there. The end valves have feeble wavy striae towards the margins, and have 10 slits in their insertion plates. The intermediate valves are strongly convex, 5 mm. wide and 4 mm. long, rounded at both sides, and having a single slit in each insertion plate."

Slits.—I have disarticulated two examples: No. 1 measuring 19×6 mm.; head valve, 12 slits; median, 1/1; tail, 10. No. 2, head valve, 9; median valve, 1/1; tail valve, 9 slits. While in the genus *Acanthochiton* the slitting in the end valves is most regular, in the ISCHNOCHITONIDAE and other genera where there is multi-slitting, even in the same species there is often irregularity in the slitting of the end valves. Angle of divergence, 90°.

Scales.—The girdle scales are quite distinct from those of *I. elizabethensis* Pilsbry in that they are smaller, more or less opaque, brown in colour except the edges, which are whitish, flat, not imbricated or turned over or polished, as in that species; they are partly erect, but placed so closely together that only a small part of each scale is visible, making them appear smaller than they really are; the angle at which the scales are attached to the girdle gives them a chaffy appearance. Under a simple lens, ×20, the scales appear smooth (as stated by Pilsbry), but under 65 mag. the striae can be just

perceived, and when magnified about 130 times the striae are well marked, about sixteen extending up to the apex of each scale; the scales measure $87\ \mu$ to $110\ \mu$ in width.

Colour and Pattern.—In my paper on the Chitons in the Turton Collection (*loc. cit.*) I pointed out that colour and pattern have little or no specific value in *Polyplacophora*. This species and *I. elizabethensis* both vary and have many colour patterns in common, and, strange to say, similar colours and patterns recur in Australian and New Zealand species. I add, "We are hardly justified in assuming that similarity of environment is the only inducing cause." Then follow a list and description of eight colour varieties lettered A to H.

Ischnochiton oniscus alfredensis n. subsp.

(Pl. V, fig. 54.)

Introduction.—From the Oxford Museum comes a single example of a very elongate form of *Ischnochiton* closely allied to *I. oniscus*; from the Transvaal Museum come two examples, both much curled, which I am considering conspecific with the first named, which was collected by Col. Turton at Port Alfred, while those from the Transvaal Museum were collected at Umkomaas, Natal. In face of the very limited available material and the inconspicuous and indefinite character of the sculpture, I am contenting myself with simply indicating the differences between it and its near allies.

Comparisons.—It differs from *I. elizabethensis* in possessing much smaller girdle scales and in the longitudinal ribs of the pleural area being further apart; from *I. oniscus* sensu stricto in that the girdle scales are a little larger, are bent over, and imbricating and semi-translucent and polished. The longitudinal ribbing in the pleural area is more spaced and only traverses that area towards the girdle. In form it differs from both in that the whole shell is narrower, longer, more elevated, and carinate; the tail valve is proportionally longer, especially in the larger example, which is figured and selected as the holotype. The anterior edge of the sutural laminae is straight as in *I. elizabethensis*, but the jugal sinus is narrower than that species; the dorsal ridge is smooth, but this may not be constant.

Inside (articulamentum).—Greyish white. Head valve—slits 10, teeth sharp and straight edged, insertion plate well developed, eaves deep. Median valve—slits $1/1$, sutural laminae anterior, margin straight, jugal sinus narrower than *I. oniscus* sensu stricto or *I. elizabethensis*. Tail valve (slightly damaged)—10 slits, jugal sinus similar.

Measurements.—Holotype, 12.5×5 mm. (dry, girdle curled); paratype (disarticulated) — head valve, 3.5×2 mm.; median valve, 4×2 mm.; tail valve, 3.5×2.5 mm. Angle of divergence, 90° .

Note.—The tail valve of the disarticulated paratype is beautifully ray-marked with dark rays, which look like hollows between ribs.

Ischnochiton elizabethensis Pilsbry.

(Pl. IV, figs. 47–49.)

I. elizabethensis, Pilsbry, Naut., viii, p. 9, 1894; *Chiton marginatus*, Sowerby, Catalogue Marine Shells of S. Africa, p. 50, 1892 (non-Pennant); Sykes, Naut., xii, No. 3, p. 41, 1898; Ashby (*loc. cit.*), p. 90.

The following is a copy of Pilsbry's type description: "Shell small, elliptical-oblong, elevated at an angle of 105° ; carinated, the side slopes somewhat convex. Colour whitish or buffish olive, finely and closely mottled all over with light olive green, or having angular patches of olive at the sides of each valve; sometimes with black-green triangles on the ridge of some valves; the posterior margins of valves more or less tessellated light and dark. Girdle indistinctly tessellated with numerous small, green bars or patches. Intermediate valves not beaked, valves finely granulated throughout, the sculpture closely resembling that of *Trachydermon cinereus* L.; lateral areas slightly raised; posterior valve having the central mucro somewhat prominent, posterior slope concave. Interior bluish, with a pair of darker green rays in each intermediate valve; the inflected posterior margin tessellated. Sutural plates small, separated by a very wide, straight, smooth sinus. Anterior valve having 10, intermediate valves 1/1, posterior valve 11 slits; teeth smooth and sharp, slit-rays showing as whitish lines; posterior tooth in intermediate valves short, removed from the posterior margin of valve by its own length. Eaves narrow. Girdle densely clothed with smooth, flattened, imbricating scales. Length, $10\frac{1}{2}$ mm.; breadth, 7 mm. Habitat, Port Elizabeth, South Africa."

Slitting of Insertion Plate.—Example (1) before disarticulation measured 15×8 mm., interior white; head valve, 13 slits; median valve, 1/1; tail valve, 10; (No. 2) head valve, 12; median valve, 1/1; tail valve, 10.

Girdle Scales.—Under pocket lens, $\times 20$, very thin, translucent, flat, and polished, very broad, edge smooth; if detached, the scale is seen to be much bent over, causing complete imbrication, the

exposed portion only shows a little bending. Under 65 mag. the anterior portion of scale is seen to be smooth, but behind that there is distinct scratching; the number of parallel striae counted under 130 mag. are 25–30; scales measured were 150–200 μ .

Comparisons.—In *I. elizabethensis* the sculpture is less coarse than in *I. oniscus*, the granules more circular; in *oniscus* the granules of the pleural area are confluent and arranged in distinct longitudinal rows right across this area; whereas in *elizabethensis* this longitudinal arrangement of the grains forms wavy riblets which do not completely cross the pleural area; briefly, in addition to the stronger sculpture of *I. oniscus*, the scales are much smaller, semi-erect, and have a chaffy appearance; whereas in *I. elizabethensis* the scales, in addition to being larger and broader, are polished, translucent, and imbricating. Both species vary extremely in colour pattern. Ashby (*loc. cit.*) describes ten colour varieties, lettering them A–J.

Ischnochiton hewitti n. sp.

(Pl. V, figs. 50–53.)

Introduction.—There are three shells from the Albany Museum (Nos. 8079, 8082, and 8085), and five from the South African Museum (No. 6757). All are bleached, but those under No. 6757 seem to have been immersed in some eroding solution, perhaps formalin, which has much injured the sculpture. These all show a distinct type of girdle scale, with a few, mostly three, strong, widely spaced ribs, instead of the exceedingly minute, numerous, parallel scratching present in the three preceding species. The best of the rather poor examples available was sent to me by Mr. John Hewitt, from the Albany Museum, who has been chiefly instrumental in getting me to undertake this monograph, and I have much pleasure in naming this species after him.

General Appearance.—Elliptical, subcarinated, slightly beaked, lateral areas raised, sculpture generally minutely decussate, girdle clothed with more or less erect scales, which are ornamented with 3–5 very strong riblets, which are widely and deeply separated. The whole shell is biscuit colour; but, as the inside is pale bluish green, the tegmentum may have been somewhat the same.

Head Valve.—Raised, much eroded, sculpture minutely granulose, a little sub-obsolete ray grooving is suggested, 2 concentric growth grooves.

Median Valve.—Arched, not carinated, side slope convex, dorsal

area is not defined; the dorsal-pleural area decussated with minute granules arranged at first in diagonal rows, gradually becoming larger and arrangement of rows longitudinal towards the girdle, the beak is sub-obsolete; lateral area is raised, 2 shallow growth sulci, and towards the girdle there is a slight suggestion of shallow ray grooving (it is possible that this feature may be more in evidence in larger and better preserved specimens).

Tail Valve.—Large, mucro ill defined, central, anterior portion small and minutely decussate, posterior portion fully twice the size of the anterior from which it is separated by a diagonal fold; general sculpture minutely decussate, but towards the girdle there are 2 well-defined, concentric, growth grooves; between the growth grooves towards the girdle are concentric rows of large grains or shallow knobs, so arranged that the grooves between are numerous and radial; this suggests the possibility of the presence of broken, radial ribbing in the outer portion of senile shells.

Inside (articulamentum).—In daylight pale greenish blue. Head valve—teeth irregular, edge straight and sharp, slits 13, eaves deep. Median valves—slits 1/1, sutural laminae small and weak, jugal sinus very broad. Tail valve—teeth very irregular in width, otherwise as in head valve, slits 12, sutural laminae weak, jugal sinus broad.

Measurements.—Whole shell (No. 8085), 13×7 mm.; the largest (No. 8079), 14.5×7.5 mm.; head valve, 2.5×4.5 mm.; median valve, 2×5 mm.; tail valve, 3×4.5 mm. Angle of divergence, 90° .

Comparisons.—As before stated, the girdle scales are most distinct as regards the sculpture in *I. hewitti*; the longitudinal riblets in pleural area are shallow, subgranulose, and flattened at top, and direction of riblets wavy-diagonal; whereas in *I. oniscus* these riblets are almost straight, outer riblets not granulose, and strongly raised; as compared with *I. elizabethensis* the granules in the pleural area are better defined but smaller.

Habitat.—Table Bay.

Note.—Since typing the above I have found a box with a few more of the above species (S.A. Mus., No. 6757), also from Table Bay, all eroded and labelled *I. elizabethensis*. Some have a distinctly bluish-coloured tegmentum. If the erosion is due to natural causes, the species may live in shallow water and belong to the half-tide horizon; if so, non-eroded examples should be looked for in positions shaded from sunlight or from complete exposure thereto.

Ischnochiton ludwigi (Krauss MSS.) Pilsbry.

(Pl. V, fig. 55.)

I. ludwigi, Pilsbry, Man. Conch., xiv, p. 99, 1892.

Pilsbry (*loc. cit.*, p. 100) quotes Krauss MSS. description of a var. *punctulata*, and on page 99 quotes another MSS. name of Krauss *Isch. zebra*. As nothing in respect to these seems to have been published by Krauss, and the notes published by Pilsbry without figures are quite inadequate for identification, we must consider both names as *nomina nuda*. On page 99 Pilsbry writes as follows: "Krauss describes specimens collected by him, and which he at one time considered a new species which he intended naming *C. ludwigi*. His description is as follows: Shell ovate-elongate, semi-pellucid, sub-carinated; white in the middle; the sides ashen green, often spotted with brown; interior white. Front valve lunate, tail valve rather depressed, submucronate in the middle; intermediate valves having the central areas finely punctate on the ridge, longitudinally striolate at the sides; lateral areas and end valves radiately rugulose-striated. Girdle ashen, submaculated, scaly, the scales small and oblong, *excessively finely multicarinated*. Length, 22 mm.; breadth, 11 mm. Table Bay."

Pilsbry considered that this belonged to the group I call "*oniscus group*." It will be seen that the definition deals mostly with colour and pattern, features which in Chitons have little or no specific value. The only distinctive portion of the definition are the words "the scales small and oblong, *excessively finely multicarinated*."

In the same box from the Albany Museum with *I. hewitti*, all under the name *I. elizabethensis*, was a dissimilar example, No. 5078, measuring 9×5.5 mm. dry. The girdle scales are distinct from any other members of the "*oniscus group*," and correspond with Krauss' description of the scales, as above. The sculpture is minutely decussate, but much hidden by some gummy matter; I suggest that it be identified with a query as *I. ludwigi* Pilsbry, as he was the first publisher of this name. The correctness of this somewhat doubtful determination must be left till more and larger material is available; if no more examples are met with I should recommend this example being considered an exotic specimen, and consider *C. ludwigi* (Krauss MSS.) Pilsbry a *nomen nudum*.

Short Key of the *Oniscus* Group.

- A. Girdle scales smooth, or striae reduced to mere scratching.
1. Scales variable in size, flat or biscuit shape, not strongly bent over, suberect *oniscus*
 2. Scales very broad, apex smooth and polished, much bent over and completely imbricated *elizabethensis*
- B. Girdle scales coarsely ribbed.
1. Scales very coarsely ribbed, with few riblets (3 to 5) *hewitti*
 2. Scales with numerous riblets, riblets less than half as wide as in *hewitti* ? *ludwigi*

Subgenus *Radsiella* Pilsbry.

Section *Radsiella*, Pilsbry, Man. Conch., xiv, pp. 54, 139, 1892.

Pilsbry defines his section *Radsiella* as follows: "Valves and girdle entirely similar to the ordinary *Ischnochiton*, but the insertion plates of the intermediate valves having two or several slits," with *Ischnochiton tridentatus* Pilsbry, the type species. Pilsbry, as shown hereunder, did not include *I. textilis* (Gray) in this section, and I had in MSS. proposed to place the following three distinctive South African forms under a new subgenus, which I proposed to name "Diktuonus" on the ground of the multisplitting of the median valves and of the peculiar network sculpture. I then noted Pilsbry's *Radsiella* section; I have not seen the type species *I. tridentatus* from Lower California, but his definition equally fits the three following species: *I. textilis* (Gray), *I. delagoensis* n. sp., and *I. tigrinus* (Krauss); should the three species, on comparison with *I. tridentatus*, be found to be not consubgeneric, I suggest that the name "Diktuonus" be adopted therefore, with *I. textilis* (Gray) as type species.

Ischnochiton (Radsiella) textilis (Gray).

(Pl. V, figs. 56-58.)

Chiton textilis, Gray, Spic. Zool., pt. 1, p. 5, 1828; *Ischnochiton textilis*, Pilsbry (part only), Man. Conch., xiv, p. 98 (non *textilis* Pilsbry, as described bottom of page 99); *I. textilis*, Thiele, loc. cit., p. 111, pl. viii, fig. 40; non *I. textilis*, Sykes, Proc. Mal. Soc. Lond., i, pt. 3, p. 132, 1894. Thiele in Schultze, Forsch. Reise, iv, p. 269, 1910.

Introduction.—Pilsbry does not appear to have been able to see an example of the true *I. textilis* (Gray) and assumed it was allied to *I. oniscus*, this error being due to the brevity of Gray's description and the fact that his figure was useless. Until receiving one of Gray's cotypes from the British Museum it was my intention to

recognise Gray's *C. textilis* in *C. tigrinus* (Krauss), as it appeared to me that Reeve figured that shell under the name "*textilis*." But since receiving the cotype from the British Museum I realise that the shell I had described in MSS. is Gray's *textilis*. The following is Gray's definition: "Shell oblong, elongate, white, pellucid when young, green with a white central band; end valves and lateral areas of the middle valves finely, radially striated and concentrically wrinkled; central area closely and minutely punctated, and *behind* finely, longitudinally striated; margin (girdle) white, minutely scaly. Length one inch and a half." To make this brief description apply to this shell the word "*behind*" has to be emended to "*before*," as the median areas are longitudinally striated anteriorly only. Also Gray's remarks about the juvenile form quite probably do not apply to this species. I have seen no juvenile. I am accepting the example sent from the British Museum, No. P739, as being a true cotype of Gray's *C. textilis*.

General Appearance.—Shell rather shallow, arched not keeled; sculpture of dorsal-pleural area changing anteriorly in mature shells into coarse, wavy, longitudinal ribbing, with irregular bridging across; lateral areas and end valves decorated with radiating coarse rugose riblets; girdle unusually broad, in dried example 3 mm. on either side, representing a fraction over one-third of total width of the animal, probably a still larger proportion when alive.

Head Valve.—Valve large, raised, decorated with closely packed radiating riblets (which measure from $162\ \mu$ to $250\ \mu$ in width towards the girdle), these riblets are broken by several concentric growth grooves. Colour, cartridge buff (Ridgway, pl. xxx); the colour is deeper at the concentric grooves, forming banding of a deeper shade.

Median Valve.—Laterally broad, arched; the posterior third of the dorsal area is eroded on all specimens, including the example described; the dorsal area is not defined, the dorsal-pleural area is decorated with coarse network sculpture, the cells or mesh vary from lanceolate to ovate, but many near the umbo are confluent; near the anterior margin the network pattern is departed from and becomes a series of longitudinal, sinuate, highly raised, convex ribs, the grooves between being deep and narrow, both the ribbing and the interspaces are irregular and in many places the ribs are confluent. In the largest of the four specimens from Saldanha Bay the network sculpture has been entirely eroded and only the conspicuous, sinuate, longitudinal ribs left on the anterior portion of shell. The lateral area is strongly

raised and decorated with bifurcating radial ribs, similar to those of the head valve but coarser, and are partially broken by deep, concentric growth grooves.

Tail Valve.—Valve large, mucro slightly ante-median, eroded, sculpture in front of mucro, similar to the dorsal-pleural area in the median valves; the portion of valve behind the mucro is same as in anterior valve except that the concentric growth grooves are more numerous and deeper, breaking the radial riblets almost into grains (300 μ wide).

Girdle is broad, 3 mm. wide, clothed with rather large imbricating white scales which are bent over anteriorly, the exposed portion appears smooth but under 65 mag. the basal half is seen to be closely scratched or shallowly grooved; it is possible that the grooving of the scales may have been affected by some solution in which the shells may have been placed.

Inside (articulamentum).—Inside white. Head valve—teeth sharp, slits 18, eaves overhanging, solid. Median valve—sutural laminae produced forward, jugal sinus very wide, teeth sharp, slits in valve 2, 4/4, but in valve 3, which is figured, insertion is broken. Tail valve—slits 14, all teeth except fourth same as head valve, but show a tendency to change in character, becoming irregularly crenate with corresponding short grooves inside, tegmentum bowed outward in the jugal sinus.

Measurements.—The shell described, S.A. Mus., No. A5340, before disarticulation was dry and curled, estimated 35×17 mm. In this condition the girdle occupies over one-third of the width; head valve, 9×5 mm.; median valve, 11×4 mm.; tail valve, 9×6 mm.; angle of divergence, 105° (valve 4).

Habitat.—Saldanha Bay (west coast); False Bay. Lüderitzbucht (Thiele).

Note.—Several examples, in spirit, have recently been sent to me by Dr. Barnard from Saldanha Bay; the largest measures 35×20 mm. Gills median, stopping 4 mm. short of either end of the foot. Gill laminae or plumes, 35/35.

Ischnochiton (Radsia) tigrinus (Krauss).

(Pl. V, figs. 59–62.)

Chiton tigrinus, Krauss, Die Südafrik. Moll., p. 38, pl. iii, fig. 5, 1848; *Chiton solea*, Sowerby, Conch., iii, fig. 61 (undescribed); *C. textilis*, Reeve (not Gray), Conch. Icon., pl. xvi, fig. 88, 1847;

I. tigrinus, Pilsbry, Man. Conch., xiv, p. 143, pl. xix, figs. 60-63, 1892 ; Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 90, pl. vii, fig. 16, 1928.

Introduction.—I have selected an example given to me by the British Museum, because both in size and markings it is almost identical with the type described by Krauss.

General Appearance.—Elliptical, dorsal-pleural areas "cellulose or pricked," lateral areas and end valves coarsely sculptured with radial granulose riblets, girdle clothed with rather large, finely striate, imbricating scales. Colour in disarticulated example somewhat faded, pale pinkish brown with wavy, sub-longitudinal banding of a darker shade ; I count four to five of these bands on each side of median valves ; this colour pattern is shown by Krauss in his figure. The South African Museum example, No. A5249, is uniformly cacao brown (Ridgway, pl. xxviii).

Head Valve.—Raised, carinated, side slope almost straight, decorated with about 70 closely packed, irregular, granulose, radiating riblets ; these are crossed by several granulose, concentric growth ridges ; three or more wavy colour bands are present.

Median Valve.—Raised, carinated, dorsal-pleural area decorated with a cellular or semi-network pattern, of which the interspaces are more or less circular ; lateral area raised, rather narrow, decorated with 7 rather confused but coarsely granulose, radial riblets, numerous growth grooves cross these ribs, the granulation at these points being very coarse, having the effect of together forming coarse granulose transverse ridges.

Tail Valve.—Raised, mucro almost median, anterior portion similar to dorsal-pleural area in median valves ; the slope immediately behind mucro is steep, rapidly becoming flatter, making the posterior slope slightly convex ; ornamentation similar to that of the lateral areas, although the concentric growth ridges are a little more marked ; there is immediately behind the mucro and in some of the interspaces a minute granulated surface to the shell ; colour banding and blotching is present.

Inside.—White to greyish white with a tinge of pink near the umbo. Head valve—eaves overhanging, insertion plate well produced, slits 16, deeply cut ; teeth sharp, straight edged. Median valve—sutural laminae fairly large, anterior edge almost straight, jugal sinus medium, tegmentum slightly bowed outwards in the sinus ; the slitting is irregular, valves 3 and 5 have 2 slits one side and 1 the other, valves 4 and 6 have 2/2 ; teeth sharp. Tail valve—13 slits, teeth sharp and fairly even.

Girdle.—Clothed with rather large, thin, imbricating scales which are finely striate.

Measurements.—Whole shell, 21.5×10.5 mm. (girdle not quite flat); head valve, 7.75×4.5 mm.; median valve (No. 5), 10×4.5 mm.; tail valve, 8×5 mm.; angle of divergence, 90° .

Habitat.—Examples before me from Port Elizabeth, Port Alfred, St. Sebastian Bay.

Comparisons.—This species is easily distinguished from *I. textilis* in that this shell is carinated and *textilis* is arched, the latter is distinctly broader; the sculpture of the dorsal-pleural areas in this is consistently throughout a cellulose or canvas-like sculpture, whereas *textilis* has a network sculpture in which the meshes are longitudinally drawn out, this sculpture changing anteriorly into wavy, longitudinal riblets; the jugal sinus in *textilis* is much broader than it is in *tigrinus*. It is distinguished from *I. delagoaensis* in that the latter possesses large-mesh network sculpture and no radial ribbing in the lateral areas.

Ischnochiton (Radsella) delagoaensis n. sp.

(Pl. VI, figs. 63–66.)

Introduction.—South African Museum, No. A6589, is a unique *Ischnochiton* collected by Dr. K. H. Barnard at Delagoa Bay. In this the network sculpture described in *I. textilis* attains its highest perfection; the beauty of this shell in sculptural design and delicacy of tracery is unsurpassed in any other member of this genus. It is with much regret that in the interest of accurate description I have been compelled to disarticulate this unique specimen, and the more so as the head valve is cracked.

General Appearance.—Elliptical, low elevation, subcarinated, side slope convex, the end valves and lateral areas ornamented with irregular, wavy, jagged riblets and a little netting, the dorsal-pleural area ornamented with large-mesh netting sculpture; girdle clothed with small, imbricating, striated scales; colour, all valves show pale blue blotches and all sculpture is pure porcelain white.

Head Valve.—Rather flat and wide laterally, porcelain white with scattered, irregular blotches or streaks of very pale greenish blue (possibly in the living shell these colour marks may be conspicuous); sculpture towards the apex network, at the apex itself (apex worn) probably minutely granulose; the outer half of valve is ornamented with vermiform, wavy, irregular riblets which on the lateral portions have a somewhat concentric arrangement.

Median Valve.—Rather flat, carinated, side slope not steep, convex, not beaked; ridge without sculpture, rest of dorsal area and pleural area sculptured with beautiful network; under 20 mag. the net is seen to be composed of strings white as porcelain, the mesh commencing small on the jugal tract and increasing rapidly both anteriorly and laterally, the net is drawn out longitudinally so that the mesh is a series of elongate rhomboids (one of these measured is $140\ \mu \times 87\ \mu$); the lateral area is raised, minutely granulose at the jugum (*i.e.* the juvenile portion of shell), changing into a series of partly diagonal, merging into sub-concentric, wavy, irregular riblets; but there is also on the anterior side of this area a little netting similar to that of the dorsal-pleural area except that the mesh is elongate vertically and not longitudinally.

Tail Valve.—Large, elevated, mucro median, the slope immediately behind vertical then concave, due to the rapid flattening of this portion; sculpture of the anterior portion similar to dorsal-pleural areas of median valves; the sculpture immediately behind the mucro is granulose, the rest of the posterior sculpture is composed of more or less parallel, wavy, or broken riblets, which are arranged longitudinally to commence with, but rapidly curving concentrically towards the middle line.

Inside (articulamentum).—White. Head valve—insertion plate shallow, slits 10, teeth sharp, irregular, slits deeply cut, eaves overhang. Median valve—slits 1/1, sutural laminae shallow, jugal sinus broad. Tail valve—slits 11. In median valves tegmentum is narrowly turned over but unsculptured.

Girdle.—Clothed with white, flat, thin, imbricating small scales, apparently smooth and polished, measuring laterally $150\ \mu$, much less vertically, under 65 mag. I could not detect any scratching, but under a higher magnitude I counted 12 striae on one scale.

Measurements.—Whole shell, 10×6.5 mm.; head valve broken; median valve, 4.75×2 mm.; tail valve, 4×2.5 mm.; angle of divergence, 100° .

Habitat.—Delagoa Bay.

Comparisons.—The large network sculpture of this species is very distinct from the cellulose sculpture of *I. tigrinus* Krauss; it more nearly approaches the sculpture of *I. textilis* Gray, but in that species the strands or riblets forming the network are much coarser and change anteriorly into coarse longitudinal ribs, a feature quite absent in the species under examination; also in *textilis* the lateral areas are radially ribbed, which is not the case in *delagoensis*. At first I

thought that this might be the juvenile form of *I. textilis*, but although in all the specimens of *I. textilis* before me the juvenile portion of the shell is eroded, I am satisfied from the data advanced that *I. delagoensis* is quite distinct.

Note.—Thiele, *loc. cit.*, p. 90, pl. ix, figs. 32–36, describes and figures a n. sp. of Chiton under the name *Chiton (Clathropleura) peregrinus* Thiele. The figure shows in the median valve a network sculpture that suggests *I. textilis*, but the other sculpture is certainly distinct. Thiele believed that it came from Algoa Bay.

Family CHITONIDAE Pilsbry.

Subfamily CHITONINAE Pilsbry.

Use of subgeneric names *Clathropleura*, *Rhyssoplax*, and *Anthochiton* discussed. Thiele (Das Gebiss der Schnecken, ii, p. 367, 1893) proposed the use of the name *Clathropleura* Tiberi (Bull. Soc. Mal. Italy, iii, p. 136, 1877) as a subgenus of the genus *Chiton* L., citing *C. siculus* Gray=*C. sulcatus*, and adopted this name throughout his later work of 1909. Pilsbry subsequently (Man. Conch., xv, p. 67) selected *Callochiton laevis* (Mont) as type of *Clathropleura* Tiberi. Iredale (Proc. Mal. Soc. Lond., ix, 1910) points out that Tiberi gave no diagnosis, but listed three species in his paper *C. laevis*, *C. corallinus* Riss., and *C. sulcatus*, with *C. siculus* Gray as synonym. Iredale then states that the concluding portion of Tiberi's paper containing the *C. siculus* Gray was printed on the cover of the next volume, dated 1878, and he therefore assumes that the two volumes were not published at the same time. He then cites *C. laevis* (already cited by Pilsbry, 1893) as Tiberi's type of *Clathropleura*. He then proposes the use of Thiele's subgenus *Rhyssoplax* with type *C. affinis* Issel as a substitute for the subgenus *Clathropleura* as used by Thiele, with *Anthochiton* Thiele, 1893, as a synonym; basing his treatment on the grounds (Int. Rules, Article 30A) that *C. siculus* Gray "was not included under the generic name at the time of its original publication."

I submit (1) that no evidence has been adduced to prove that the two volumes in which Tiberi's paper was published were not issued at one and the same time. (2) That the name "*C. affinis* Issel" was not published by Thiele until his second work of 1910. (3) That therefore Thiele's subgeneric name *Anthochiton*, with *Chiton tulipa* Quoy and Gaimard as type of the genus, dates from Thiele's earlier work of

1893, p. 377. (4) As no adequate definition has yet been published to warrant the elevation to generic status of any of the three names quoted above as proposed as subgenera by Thiele, I have in this monograph elected to use none of them. Their proposal was based almost entirely on characters of the radula.

Chiton tulipa Q. and G.

C. tulipa, Quoy and Gaimard, Voy. l'Astrolabe, Zool., iii, p. 389, pl. lxxiv, figs. 35-36, 1834; Krauss, Die Südafrik. Moll., p. 37; Reeve, Conch. Icon., pl. iii, fig. 18; Pilsbry, Man. Conch., xiv, p. 185, 1892; Sykes, Proc. Mal. Soc. Lond., i, pt. 3, p. 134, 1894; Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 87, 1928; *C. cymbiola*, Sowerby, Mag. Nat. Hist., p. 292, 1840.

The following is Pilsbry's description: "Shell oval, oblong, elevated, acutely carinated, the side slopes nearly straight. Surface smooth and polished throughout. Ground colour buff or whitish, suffused and closely mottled all over with reddish chestnut, fawn or purple brown, usually longitudinally streaked in the central areas, zigzagged or tessellated on the end valves, and articulated on the diagonal lines with the darker colour. Sometimes parts of some valves or several whole valves are of a uniform dark brown colour. The central areas are smooth except for slight growth lines and a microscopic granulation which covers the whole surface. Lateral areas well raised, flat, rarely with slight radii, smooth in the excavation at the diagonal line, a lens shows a few very short longitudinal grooves in some specimens. Tail valve elevated with central umbo. Interior very light blue green, each valve rayed with brown at the beaks. Anterior valve having 8, central valves 1/1, posterior valve 12 slits; teeth pectinated, eaves short, spongy, grooved along the teeth. Sinus narrow, denticulate. Girdle, solid, closely covered. Angle of divergence, 100° to 112°, with smooth, convex scales."

Habitat.—I have seen examples from the following localities: St. Sebastian Bay, Simons Bay, Camps Bay (west coast of Cape Peninsula), and Port Alfred.

Chiton tulipa alfredensis Ashby.

(Pl. VI, figs. 67-69.)

C. tulipa alfredensis, Ashby, Proc. Mal. Soc. Lond., xviii, pt. 2, p. 87, 1928. Ashby, in describing this variety or subspecies (which status is

justified must remain for workers on the spot to determine) on page 88, says: "The example I am selecting as type is, in common with the others, much curved, and measures along the dorsal ridge about 45 mm., has 10 to 12 grooves, with their corresponding short longitudinal ribs on each valve. In other respects they are similar to *C. tulipa* s.s. Pilsbry states: 'The short traces of grooves at the diagonal line are rarely visible without a lens,' whereas in all the examples under discussion the grooves are most marked and easily seen if looked at laterally without a lens. I certainly consider this very distinct form deserves a name, judging from the fact that all the half-grown to adult specimens in this collection from Port Alfred have this feature. I am giving it the subspecific name of *alfredensis*. Quoy and Gaimard, in the original description, make no mention of ribs or pits in the pleural areas, neither do they figure such. I would therefore indicate that *C. tulipa* s.s. is the smooth ungrooved form."

"The more perfect girdle scales in my holotype are translucent, highly polished, and closely, minutely striate, the apices minutely pitted under 65 mag.; they are also much bent over. The inside is bluish, translucent, insertion plate thick and pectinate, anterior valve 8 slits, median valve 1/1, tail valve 11, sutural laminae large, sinus between medium and the laminae joined across by a series of 10 or more blunt denticles; in the median valves the articulamentum is much thickened at the edge of the lateral areas, and the thickened eaves perforated by a series of holes which are most likely nerve-fibre channels." Angle of divergence, 93°. This last paragraph will equally apply to *C. tulipa* s.s. In conclusion: As far as I can determine, all or nearly all the Port Alfred examples in the various collections assembled before me belong to the subspecies *alfredensis*, but I have seen a specimen said to come from Camps Bay (west side of Cape Peninsula) which exhibits similar grooving and ribbing; therefore it looks likely that *alfredensis* is not a true geographic race but one of two distinct forms that exist side by side: future work must decide this.

Chiton crawfordi Sykes.

(Pl. VI, figs. 70-73.)

C. crawfordi, Sykes, Proc. Mal. Soc. Lond., iii, p. 279, 1899; *Ischnochiton* (in error) *crawfordi*, Ashby, loc. cit., p. 90, 1928.

General Appearance.—Elliptical, carinated, slightly beaked, lateral areas much raised; the whole shell is smooth except for a series of pits and grooves in the pleural area, where it abuts on the lateral,

which commence near the jugum as small pits and increase rapidly in size till, as the girdle is approached, they traverse the whole of this area; girdle broad, clothed with rather large imbricating scales; colour and pattern are variable, in shades of pink, olive, and dark brown.

Head Valve.—Broad and elevated, minutely decussate all over, possessing several distinct but shallow concentric growth grooves.

Median Valve.—Much elevated and carinated, side slope steep but slightly convex, dorsal area and upper portion of pleural minutely decussate; the only striking feature is the existence of a series of pits and grooves in the pleural area, commencing near the jugum as small pits and rapidly increasing in size until they form deep and broad grooves, traversing longitudinally the whole of the area. I count 6 of these latter, separated from each other by very broad and strong ribs; from these to the jugum are 8 pits and gashes, making a total of 14 in all; narrow transverse growth grooves cross the smooth portion of the dorsal-pleural area. Lateral area strongly raised and without sculpture except the minute decussation.

Tail Valve.—Unfortunately this valve in the disarticulated example is an abnormality, being a combination of parts of both 7th and 8th valves; mucro about central, posterior slope concave, anterior portion similar to pleural areas, and posterior similar to lateral areas, strongly raised separating rib.

Inside (articulamentum).—White, teeth serrate, eaves do not overhang, insertion plate extends beyond the eaves; head valve 8 slits, median valve 1/1, tail valve, Sykes gives 9 slits. The sutural laminae are shallow, laterally broad, jugal sinus narrow; a strongly serrate spade-like process connects across the sinus except for a bilateral slit.

Girdle.—Clothed with rather large, polished, imbricating scales, the exposed portion shuttle shaped, and grooved with shallow, closely packed striae; actually the scales are bent double, the exposed half imbricating.

Measurements.—Three examples have been sent to me from the Natal Museum, and a single median valve from the Oxford Museum, this latter collection by Col. Turton at Port Alfred. Whole shells, 26×14 mm., 19×9.5 mm., and 18×10 mm. respectively; head valve, 8×4.5 mm.; median valve, 10×6 mm.; tail valve (abnormal), 9×7 mm.; angle of divergence, 90° .

Habitat.—Port Shepstone; Port Alfred. Sykes gives Algoa Bay as locality of his type.

Chiton barnardi n. sp.

(Pl. VI, figs. 74-76 ; Pl. VII, fig. 77.)

Introduction.—There are two examples in the collection from the South African Museum of a very striking and hitherto undescribed *Chiton* which I have pleasure in naming after the discoverer Dr. K. H. Barnard. These are numbered respectively A6590, A5331 ; both were collected at the Island of Mozambique ; as the latter is in better preservation and retains its colour I am making it the holotype and disarticulating the paratype.

General Appearance.—Holotype curled, shell much elevated, slightly carinated, side slope steep and convex, end valves and lateral areas decorated with strong, subnodulose ribs, dorsal area smooth on most valves, and pleural area deeply and broadly longitudinally grooved ; girdle clothed with imbricating scales. Colour of holotype ochraceous salmon (Ridgway, pl. xv), girdle same colour, banded with white, the sides of the tail valve blotched with brown. Paratype—the colour of this specimen has faded, but shows a broad, pale, dorsal band on all valves after the second, with brown pleural areas.

Head Valve.—Strongly raised, anterior slope steep, convex, decorated with 10 broad, strongly raised, rounded ribs, which are in places shallowly, transversely ridged, and subgranulose at the side.

Median Valve.—Subcarinated and highly arched, side slope steep, convex, dorsal area defined, broadly wedge shaped and smooth. Pleural area possesses 9 deep, longitudinal grooves, all except the four nearest the dorsal ridge practically cross the area, although stopping just before actually reaching the anterior margin. Lateral area—this area is narrow and composed of 2 strongly raised, broad, subnodulose, rounded ribs.

Tail Valve.—Dorsal area smooth, except that, in common with some of the median valves of holotype, the first pair of longitudinal grooves are bowed upwards across the dorsal area, otherwise the anterior sculpture is similar to that of the pleural areas. The whole valve is truncated at the mucro, the posterior margin of valve is immediately beneath the mucro (which is in centre of valve), so that a vertical line would cut both the shell margin and the mucro. The posterior portion of valve is convex, decorated with 8 very strong radiating ribs ; these in the holotype number 10 and are sub-obsolete nodulose. This difference is still more apparent in the head valve, for in the holotype the lateral nodules on the ribs in that valve almost bridge across the intervening sulcus.

Inside.—Greyish white, translucent, polished; eaves barely overhang, spongy; teeth thick with bluntly serrate edge, grooved outside, smooth inside; anterior valve, slits 9; median valve, slits 1/1; tail valve, slits 13 (one of which seems an interpolation and a true slit); teeth very irregular and in the centre small, much grooved, dentate, and crowded; sutural laminae rather shallow, jugal sinus medium, narrowly joined across the median line, edge in sinus minutely serrate.

Girdle.—Clothed with large, imbricating scales, the grooving or fluting on the scales is easily detected under 20 mag., a short spiculose girdle-fringe is present on holotype. Detached scales measure $150 \times 90 \mu$, are translucent and deeply grooved with 7–8 grooves.

Measurements.—Whole shells too curled to measure; anterior valve (No. 4), 2.5×2.75 mm.; median valve, 4.5×2.5 mm.; tail valve, 2.5×2.75 mm. Angle of divergence, 80° .

Habitat.—Mozambique Island.

In conclusion.—The spongy eaves, the serrate extension of the articulamentum across the jugal sinus, and the peculiar truncated tail valve suggest possible justification for subgeneric separation, but for reasons I have advanced under the heading "Subgeneric Discussion" I leave it under the genus *Chiton*.

Subgenus *Sypharochiton* Thiele.

Sypharochiton, Thiele, Das Gebiss der Schnecken, ii, p. 365, 1893; type of subgenus *Chiton pellis-serpentis* Quoy and Gaimard.

Chiton (Sypharochiton) nigrovirens Blainville.

(Pl. VII, figs. 78–81.)

Chiton nigrovirens, Blainville, Dict. Sci. Nat., xxxvi, p. 538, 1825; Haddon, Challenger, Polyplac., p. 22, 1886. *C. capensis*, Gray, Spic. Zool., p. 5, 1828; Hanley, in Wood, Index Test. Suppl., i, fig. 11; Reeve, Conch. Icon., xxii, fig. 151; Krauss, Die Südafrik. Moll., p. 37. *C. nigrovirescens*, Sowerby, Cat. S. Afr. Mollusca, 1892. *C. nigrovirens*, Sykes, Proc. Mal. Soc. Lond., i, pt. 3, p. 132, 1894. *C. (Sypharochiton) nigrovirens*, Ashby, loc. cit., pp. 91, 93, pl. vii, fig. 17; Thiele in Schultze, Forsch. Reise, iv, p. 269, 1910.

General Appearance.—Elliptical, raised, arched, not carinated, strongly beaked; end valves and lateral areas decorated with shallow

ray-riblets; dorsal-pleural area indistinctly, longitudinally grooved; colour black, girdle banded; most other examples are grey and badly eroded; girdle clothed with large, solid, opaque, imbricating scales.

Head Valve.—Raised, rather large, laterally wide, decorated with about 30 closely packed, radial riblets, which are subgranulose; the whole surface of shell is minutely decussate.

Median Valve.—Arched, not carinated, side slope flat and convex; the dorsal-pleural area longitudinally but feebly grooved, the portion towards the jugum almost smooth; lateral areas raised and decorated with about 6 radial, granulose riblets.

Tail Valve.—Large, mucro anterior, defined; posterior slope steep; posterior portion double the size of the anterior, due largely to the lateral expansion of the shell; anterior portion unsculptured except for narrow growth grooves and minute granulation; posterior portion similar to the head valve.

Inside (articulamentum).—Bluish grey, except insertion plates and sutural laminae, which are dirty white; eaves spongy, insertion plate well produced. Head valve—slits 12, narrow and deeply cut; teeth irregular and sharply serrate; tegmentum narrowly infolded at the apex. Median valve—slits 1/1, serrate; sutural laminae shallow, jugal sinus very broad, and articulamentum extending one-third across on either side. Tail valve—slits 15; teeth uneven, very serrate; articulamentum shallowly joined across, edge bluntly dentate.

Girdle.—Clothed with large, solid, dull, opaque, imbricating scales without striae.

Measurements.—Whole shell (photo), 14×8.5 mm.; head valve, 7×3 mm.; median valve, 8.5×3 mm.; tail valve, 6×3.5 mm.; angle of divergence, 110° .

Habitat.—False Bay (S.A. Mus., A5337), Table Bay; one example (S.A. Mus., No. A5338) from Lüderitzbucht, S.-W. Africa; Port Alfred; Lüderitzbucht (Thiele).

Juvenile.—From the Turton Coll. (U.S. Nat. Mus., No. 125380) comes a juvenile example showing absence of sculpture except for microscopic granulation and growth lines.*

* Note by K. H. Barnard. Thiele (*loc. cit.*, 1910) refers to the presence of young under the mantle (girdle) edge. The same fact was observed in the case of the specimens collected by me at Smitswinkel Bay, False Bay, in July 1912. The young are about 75 mm. in length.

Subfamily LIOLOPHURINAE Pilsbry.

Subfamily *Liolophurinae*, Pilsbry, Man. Conch., xiv, p. 232, 1892.

Pilsbry's diagnosis must be enlarged and made to correspond with subfamily *Acanthopleurinae*, Thiele (*loc. cit.*, p. 117, 1909).

Note.—It must be admitted that the restricted genus *Liolophura* is not as typical as is the genus *Acanthopleura* of the group assembled by Thiele (and quite rightly so, I think), under his subfamily *Acanthopleurinae*; but under the International Rules of Nomenclature we are compelled to accept the earlier name.

Acanthopleura brevispinosa (Sowerby).

(Pl. VII, fig. 82.)

Chiton brevispinosa, Sowerby, Mag. Nat. Hist., p. 287, pl. xvi, fig. 1, 1840; Conch., iii, fig. 136; Reeve, Conch. Icon., fig. 52; *Acanthopleura brevispinosa*, Rochbrune, Nouv. Arch. du Mus., p. 240, 1881; *A. afra*, Rochbrune, Bull. Soc. Philom., p. 192, 1881-2; *A. quatrefagei*, Rochbrune, *loc. cit.*, p. 117, 1880-1; Journ. de Conch., p. 44, 1881; Ashby, *loc. cit.*, p. 91, 1928; *A. spinigera*, Odhner, Arkiv. Zool. Band., ii, No. 6, p. 21, 1919.

Note.—Pilsbry placed this species under his subgenus *Amphitomura*, of which *A. borbonica* Des. is the type species. I find a close resemblance between the various forms of *Acanthopleura* found on the coasts of the Indian Ocean, and think it quite possible that a careful investigation might necessitate considering most, if not all, as geographical races, *i.e.* subspecies of *Chiton gemmatus* Blainville (Dict. Sci. Nat., xxxvi, p. 544, 1825). At least the fairly extensive material in my own collection points to the futility of generically separating up the members of this group on the definitions supplied by various workers.

General Appearance.—Broad, subcarinated, beaked, shell much eroded, sculpture consisting of coarse, broken, wavy, irregularly granulose, more or less concentric riblets. Girdle very broad, beset thickly with short, stout, blunt calcareous spicules, with numberless much shorter spicules thickly intermingled. The end valves and the lateral areas are furnished with "eyes"; the example is not disarticulated; colour brown, with a dark dorsal stripe margined by a pale band.

Head Valve.—Very large, flat, upper half eroded, outer half decorated with wavy, concentric rows of granulose riblets, changing

in parts into disconnected grains; numerous "eyes" are present, mostly in the grooves.

Median Valve.—Valve 2 measures longitudinally half as much again as the others, subcarinated, beaked, upper third eroded, central portion decorated with widely spaced, irregular granules, which become much larger towards the girdle and are there arranged concentrically; "eyes" most numerous near the girdle.

Tail Valve.—Badly eroded, mucro at posterior third, sculptured with granules arranged concentrically; eyes quite numerous on the non-eroded portion.

Inside.—Pilsbry gives "anterior valve 7-8, central 1, posterior 2, slits, and a number of irregular serrations; anterior teeth moderately long, finely pectinated outside; posterior teeth very short, blunt, obsoletely pectinated."

Girdle.—Densely clothed with coarse, blunt, short, calcareous spicules, the interspaces crowded with very short almost pebble-like spicules.

Measurement.—Dry, much curled, 25×21 mm. Angle of divergence, 130° (Pilsbry).

Habitat.—Mozambique Island (S.A. Mus., No. A5330).

Onithochiton literatus (Krauss).

(Pl. VII, figs. 83-86.)

Chiton literatus, Krauss, Die Südafrik. Moll., p. 36, pl. iii, fig. 6; *C. wahlbergi*, Krauss, Die Südafrik. Moll., p. 36, pl. iii, fig. 1; *Onithochiton literatus*, Pilsbry, Man. Conch., xiv, p. 251, pl. lv, figs. 22-23, 1892; *Plaxiphora wahlbergi*, Pilsbry, loc. cit., p. 322, pl. lv, figs. 17-18, 1892; *Onithochiton literatus* and *O. wahlbergi*, Thiele? same species, Rev. Syst. der Chit., p. 98, 1909; Ashby, loc. cit., p. 91, note 92, 1928; *O. lyalli*, Odhner (non-Sowerby), Faun. Malac. de Madagascar, p. 40, 1919; Arkiv. Zool., B. 12, No. 6.

Introduction.—It will be seen from the above synonymy that I consider *C. literatus* and *C. wahlbergi*, both of Krauss, as conspecific. Pilsbry considered *C. wahlbergi* as belonging to the genus *Plaxiphora*, treating it as the only representative of a distinct group. I noticed that Krauss' figure of the whole shell, in both proportion and shape, is that of a typical *Onithochiton* and not that of a *Plaxiphora*; the insertion plate and head valve, as shown in his figures, are characteristic of the genus *Onithochiton* and not of that of *Plaxiphora*, and in addition Krauss states "girdle brown, leathery, velvety," a descrip-

tion that could not apply to the strongly spiculose girdle of the genus *Plaxiphora*.

Krauss, immediately under his figure of *C. wahlbergi*, figures another *Onithochiton*, which is not eroded as is the first figure; this he calls *C. literatus*. In this figure the shape of the valves is similar to that of *C. wahlbergi*, except that the tail valve is a little pointed, whereas *wahlbergi* is blunt, due no doubt to erosion. I consider these conspecific, for the following reasons: (a) It is unlikely that two distinct species of the restricted genus *Onithochiton* will be living together; (b) the amount of variation revealed in Krauss' figures and descriptions and in the series of examples now before me is no more than is common in the species found along the Western Australian coast from Shark Bay in the north to the Leeuwin in the south, and called *Onithochiton quercinus occidentalis* Ashby. Since writing the foregoing notes I have read a translation of Thiele's work of 1910, in which he states that he had come to the same conclusion.

General Appearance.—Animal elongate, sides parallel, not wider in the middle as in most Chitons, shell arched, strong, broken, growth grooves around outer margin of all valves; sculpture of dorsal-pleural area covered with numerous, deep, longitudinal, and diagonal grooves. These grooves in the lateral areas are broken and irregular; the ground colour is dark and the sculpture several shades of lighter brown. "Eyes," with a grey cornea 36μ in diameter, are so scattered over the head valve, on the outer margin only in the tail valve, and in the lateral area of the median valves.

Head Valve.—The sculpture of two-thirds of the non-eroded portion of the example under examination consists of a series of large irregular and very angular, flattened grains, which in the main follow the concentric grooves. These, almost blocks of flattened sculpture, are in places joined across the concentric growth grooves; those furthest from the girdle are still more irregular and vermiform; "eyes" are scattered over this valve.

Median Valve.—The shell is very flat, the dorsal-pleural area is decorated with numerous flat-topped, diagonal riblets, converging anteriorly. These ribs are separated by deep grooves, which are less than half the width of the riblets; these are broken where crossed by growth grooves; the lateral areas are crossed by a series of large, irregular grains, which are more circular than in the head valve, the grains follow deep, concentric growth grooves; "eyes" present on anterior half of this area.

Tail Valve.—Very flat, mucro undoubtedly posterior but eroded,

anterior portion similar to dorsal-pleural area, valve bent over laterally; posterior portion very narrow, growth grooves follow contour of margin and converge at the mucro; numerous "eyes" present.

Inside (articulamentum).—White. Anterior valve—insertion plate well produced, slits 8, teeth regular, closely and deeply grooved on outside, smooth inside, edge of teeth finely serrate, eaves shallow. Median valve—slits 1/1, very broad, edge of teeth numerously grooved, sutural laminae strongly produced forward, jugal sinus wide, laminae joined across the middle line by an extension of the articulamentum, which is deeply serrate. Tail valve—insertion plate obsolete, the articulamentum ending in a callus, eaves much overhung.

Girdle.—Under pocket lens brown and felty, but under 65 mag. seen to be densely covered with short, stout, rather blunt spicules; one measured was $125 \times 25 \mu$.

Measurements.—Whole shell, dried and curled, 20×12 mm.; head valve, 7.5×4.5 mm.; median valve, 10×6 mm.; tail valve, 8×4.5 mm.; angle of divergence, 105° .

Habitat.—Scottburgh; Port Shepstone; Umkomaas; Port St. Johns; Durban Bay.

Note.—Since the descriptions were written and figures made I have received from the Natal Museum several uncurled examples of this shell. One almost perfect example, measuring 35×20 mm., is broadly banded down the centre with bright chestnut, and beautifully mottled on either side with cream markings arranged in a sort of scalloped pattern. The sculpture differs little from the foregoing description. Some examples have but little sculpture left, except the deep growth grooves that follow the outer margin; in others these grooves are almost absent, and most of the valves are covered with the irregular grooved and ribbed sculpture described herein. I am grateful to Dr. E. Warren, Director of the Natal Museum, for so kindly sending along these specimens, for they fully confirm the conclusion already come to that *C. wahlbergi* and *C. literatus* are conspecific. The latter name has line precedence.

Chitons which have been incorrectly credited to the South African Fauna or about which there is grave doubt.

Acanthochiton spiculosus Reeve.—Sykes states this was recorded from Port Elizabeth by Sowerby, in error; it is a West Indian species.

Plaxiphora carmichaelis Gray, 1828.—Sykes considers this conspecific with *Chiton setiger* King, 1831, and therefore Gray's name antedates that of King. It is a South American species.

Ischnochiton cyaneopunctatus, Krauss, Die Südafrik. Moll., p. 40, pl. iii., fig. 2, 1848. Krauss' figure and description fit perfectly with *Ischnochiton lentiginosus*, Sowerby, Mag. Nat. Hist., iv, p. 293, 1840. A common shell in New South Wales, Australia. It is evident that through error Krauss described an Australian species in mistake for a South African one. That South Africa does possess a blue spotted *Ischnochiton* I have shown in my description of *I. delagoaensis*; but this species belongs to a group of the genus *Ischnochiton*, entirely different from the species described and figured by Krauss, and is only known up to the present by the unique example described herein. It is, however, quite possible that *delagoaensis* extends down along the Zululand and Natal coast.

Ischnochiton pruinosus Gould, 1846, is a South American shell incorrectly recorded as from South Africa by Sowerby under the name of *Chiton pruinosus*.

Acanthopleura afra, Rochebrune, 1881, and *A. quatrefagesi*, Rochebrune, 1882, have both been recorded as from the Cape of Good Hope and Madagascar. Pilsbry included them in his list of "Insufficiently described Chitons," and Sykes expressed grave doubts as to the correctness of the localities given. I have included both as synonyms of *Acanthopleura brevispinosa* Sowerby.

Extra-limital Chitons.

I am not clear as to what the recognised boundaries are of the Faunal Region of South Africa, but I assume that Madagascar is not included; but as it is likely that there may be species common to both sides of the Mozambique Channel I give below names of those species listed or described by Dr. Nils Hj. Odhner in his paper on "Faune Malacologique de Madagascar, 1919."

Acanthochiton aberrans, Odhner, p. 22, Majunga; *A. penicillatus*, Deshayes, p. 40, Tamatave; *Choneplax indicus*, Deshayes, p. 40, Tamatave; *Ischnochiton rufopunctatus*, Odhner, p. 21, Majunga; *Acanthopleura spinigera*, Sowerby, p. 21, Majunga. This I have queried (*supra*) as being *A. brevispinosa* (Sowerby), but have pointed out that this, as well as *A. spinigera* Sow., are probably subspecies of *A. gemmatus* Blainville, 1825. *Onithochiton lyellii*, Sowerby, p. 40, Tamatave—this record I have placed under *O. literatus* (Krauss).

CHECK LIST OF SOUTH AFRICAN CHITONS.

CLASS AMPHINEURA.

ORDER POLYPLACOPHORA (Blainville emend.) Gray, 1821.

(PRIMITIVE.)

SUBORDER EOPLACOPHORA Pilsbry, 1900. (Palaeozoic only.)

Family GRYPHOCHITONIDAE Pilsbry, 1900. (Palaeozoic only.)

SUBORDER PROTOCHITONINA Ashby, 1928.

Family PROTOCHITONIDAE Ashby, 1925. (Fossil only.)

Family ACANTHOCHITONIDAE Hedley, 1916.

Subfamily AFOSSOCHITONINAE Ashby, 1925. (Fossil only.)

(ADVANCED.)

Subfamily ACANTHOCHITONINAE Ashby, 1925.

Genus *Acanthochiton* Gray emend., 1821.*Acanthochiton garnoti* (Blainville), 1825.*Acanthochiton turtoni* Ashby, 1928.*Acanthochiton turtoni* var. *tenuigranulosus* Ashby.Genus *Notoplax* H. Adams, 1861.*Notoplax productus* (Pilsbry), 1892.

Subfamily CRYPTOPLACINAE Thiele, 1909.

Genus *Cryptoplax* Blainville, 1918.*Cryptoplax sykesi* Thiele, 1909.*Cryptoplax dupuisi* Ashby (Madagascar).

(PRIMITIVE.)

SUBORDER LEPIDOPLEURINA Thiele, 1909.

Family LEPIDOPLEURIDAE Pilsbry, 1892.

Genus *Lepidopleurus* Risso, 1826.*Lepidopleurus sykesi* (Sowerby), 1903.

(ADVANCED.)

SUBORDER CHITONINA Thiele, 1909.

Family CALLOCHITONIDAE Thiele, 1909.

Subfamily TRACHYDERMONINAE Thiele, 1909.

Genus *Trachydermon* Carpenter, 1863.Subgenus *Craspedochilus* Sars, 1878.*Trachydermon* (*Craspedochilus*) *turtoni* Ashby, 1928.

Subfamily CALLOCHITONINAE Thiele, 1909.

Genus *Callochiton* Gray, 1847.Subgenus *Trachyradsia* Dall, 1878.*Callochiton* (*Trachyradsia*) *castaneus* (Wood), 1815.

Family MOPALIIDAE Pilsbry, 1892.

Genus *Plaxiphora* Gray, 1847.

- Plaxiphora simplex* Haddon (Tristan da Cunha).
 Family ISCHNOCHITONIDAE Pilsbry, 1892.
 Subfamily CHAETOPLEURINAE Thiele, 1909.
 Genus *Chaetopleura* Shuttleworth, 1853.
Chaetopleura papilio (Spengler), 1797.
Chaetopleura pertusus (Reeve), 1847.
Chaetopleura destituta Sykes, 1902.
 Genus *Dinoplax* Dall, 1882.
Dinoplax gigas (Gmelin), 1788.
 Subfamily ISCHNOCHITONINAE Pilsbry, 1892.
 Genus *Ischnochiton* Gray, 1847.
Ischnochiton oniscus (Krauss), 1848.
Ischnochiton oniscus alfredensis Ashby.
Ischnochiton elizabethensis Pilsbry, 1894.
Ischnochiton hewitti Ashby.
Ischnochiton ludwigi (Krauss MSS.) Pilsbry, 1892.
 Subgenus *Radiella* Pilsbry, 1892.
Ischnochiton (*Radiella*) *textilis* (Gray), 1828.
Ischnochiton (*Radiella*) *tigrinus* (Krauss), 1848.
Ischnochiton (*Radiella*) *delagoensis* Ashby.
 Family CHITONIDAE Pilsbry, 1892.
 Subfamily CHITONINAE Pilsbry, 1892.
 Genus *Chiton* Linne, 1758.
 Subgenera *Clathropleura*, *Rhyssoplax*, and *Anthochiton* (not used).
Chiton tulipa Quoy and Gaimard, 1834.
Chiton tulipa alfredensis Ashby, 1928.
Chiton crawfordi Sykes, 1899.
Chiton barnardi Ashby.
 Subgenus *Sypharochiton* Thiele, 1893.
Chiton (*Sypharochiton*) *nigrovirens* Blainville, 1825.
 Subfamily LIOLOPHURINAE Pilsbry, 1892.
 =ACANTHOPLEURINAE Thiele, 1909.
 Genus *Acanthopleura* Guilding, 1829.
Acanthopleura brevispinosa (Sowerby), 1840.
 Genus *Onithochiton* Gray, 1847.
Onithochiton literatus (Krauss), 1848.
 =*O. wahlbergi* Krauss, 1848.

EXPLANATION OF TEXT-FIGURES 1 AND 2.

FIG. 1. Composite diagram of a Chiton to illustrate terminology. Parts of the shell: A, Head valve; B, Six median valves; C, Tail valve; D, Girdle; E, Dorsal area; F, Pleural area; G, Lateral area; H, Mucro. Sculpture: I, Radial ribbing; J, Longitudinal ribbing; K, Granulose; L, Radial granulose ribbing; M, Radial bifurcating ribbing; N, Scales (smooth or striate); O, Tufts of spicules or hair tufts; P, Calcareous spines; Q, Girdle-fringe. (Adapted from Iredale and Hull, 1923.)

FIG. 2. *Cryptoplax sykesi* Thiele: a, whole animal; b, head valve; c, seventh valve; d, eighth valve. (From Sykes.)

EXPLANATION OF PLATES.

PLATE I.

FIG.

1. *Acanthochiton garnoti* (Blainville). Cape. Whole shell. Ashby Coll. $\times 4$.
2. *Acanthochiton garnoti* (Blainville). Cape. Head valve, showing broad insertion plate with 5 slits. Ashby Coll. $\times 6\frac{1}{2}$.
3. *Acanthochiton garnoti* (Blainville). Same example as No. 2. Median valve. $\times 6\frac{1}{2}$.
4. *Acanthochiton garnoti* (Blainville). Same example as No. 2. Tail valve, having 2 slits only. $\times 6\frac{1}{2}$.
5. *Acanthochiton turtoni* Ashby. Port Alfred. Holotype. Whole shell. Oxford Mus. $\times 6\frac{1}{2}$.
9. *Notoplax productus* (Pilsbry). Jeffrey's Bay. Whole shell curled, showing great width of girdle. Trans. Mus., No. 759. \times about $5\frac{1}{2}$.
10. *Notoplax productus* (Pilsbry). Same example as No. 9. Head valve. $\times 5\frac{1}{2}$.
11. *Notoplax productus* (Pilsbry). Same example as No. 9. Median valve, insertion plate broken, slit inconspicuous. $\times 5\frac{1}{2}$.
12. *Notoplax productus* (Pilsbry). Same example as No. 9. Tail valve, showing very broad slits. $\times 5\frac{1}{2}$.

PLATE II.

6. *Acanthochiton turtoni* Ashby. Holotype. Same example as No. 5. Holotype. Head valve, incomplete insertion plate. $\times 7$.
7. *Acanthochiton turtoni* Ashby. Holotype. Same example as No. 5. Median valve. $\times 7$.
8. *Acanthochiton turtoni* Ashby. Holotype. Same example as No. 5. Tail valve. $\times 7$.
13. *Acanthochiton turtoni* var. *tenuigranulosus* nov. Port Alfred. Holotype of variety. Ashby Coll. $\times 5$.
14. *Cryptoplax dupuisi* n. sp. Madagascar. Holotype. (Straightened out for photo.) Whole shell, showing small, widely spaced valves. Ashby Coll. $\times \frac{1}{3}$.
15. *Cryptoplax dupuisi* n. sp. Madagascar. Holotype. Same example as No. 14. $\times 2\frac{1}{3}$.
16. *Lepidopleurus sykesi* (Sowerby). Dredged off Cape Point. Whole shell, much curled. S.A. Mus., No. A5343. $\times 4\frac{1}{2}$.
17. *Lepidopleurus sykesi* (Sowerby). Same example as No. 16. Head valve. $\times 6$.
18. *Lepidopleurus sykesi* (Sowerby). Same example as No. 16. Median valve, showing weak sutural laminae. $\times 6$.
19. *Lepidopleurus sykesi* (Sowerby). Same example as No. 16. Tail valve. $\times 6$.
20. *Trachydermon* (*Craspedochilus*) *turtoni* Ashby. Port Alfred. Holotype. Whole shell. Oxford Mus. $\times 7$.
21. *Trachydermon* (*Craspedochilus*) *turtoni* Ashby. Holotype. Same example as No. 20. Head valve. $\times 7$.
22. *Trachydermon* (*Craspedochilus*) *turtoni* Ashby. Holotype. Same example as No. 20. Median valve. $\times 7$.
23. *Trachydermon* (*Craspedochilus*) *turtoni* Ashby. Holotype. Same example as No. 20. Tail valve. $\times 7$.
24. *Callochiton* (*Trachyradsia*) *castaneus* (Wood). Table Bay. S.A. Mus., No. 4872. Whole shell. $\times 5$.

PLATE III.

FIG.

25. *Callochiton (Trachyradsia) castaneus* (Wood). Port Alfred. (Trans. Mus., No. 754, now Ashby Coll.). Head valve. $\times 6$.
26. *Callochiton (Trachyradsia) castaneus* (Wood). Same example as No. 25. Median valve. $\times 6$.
27. *Callochiton (Trachyradsia) castaneus* (Wood). Same example as No. 25. Tail valve. $\times 6$.
28. *Plaxiphora simplex* Haddon. Tristan da Cunha. Part of girdle. $\times 4$.
29. *Plaxiphora simplex* Haddon. Same example as No. 28. Head valve. $\times 4$.
30. *Plaxiphora simplex* Haddon. Same example as No. 28. Median valve. $\times 4$.
31. *Plaxiphora simplex* Haddon. Same example as No. 28. Tail valve. $\times 4$.
32. *Chaetopleura papilio* (Spengler). Kalk Bay. S.A. Mus., No. 4887. Median valve. Note spade-like process in jugal sinus. $\times 4$.
33. *Chaetopleura papilio* (Spengler). Same example as No. 32. Tail valve. $\times 4$.
34. *Chaetopleura pertusus* (Reeve). False Bay. S.A. Mus., No. 6766. Head valve. $\times 5$.
35. *Chaetopleura pertusus* (Reeve). Same example as No. 34. Median valve. $\times 5$.
36. *Chaetopleura pertusus* (Reeve). Same example as No. 34. Tail valve. $\times 5$.

PLATE IV.

37. *Chaetopleura destituta* Sykes. S.A. Mus., No. 4880. Whole shell, about natural size, girdle expanded a little for photo.
38. *Chaetopleura destituta* Sykes. S.A. Mus., No. 4874. Half median valve. $\times 4$.
39. *Chaetopleura destituta* Sykes. Same example as No. 38. Tail valve. $\times 4$.
40. *Dinoplax gigas* (Gmelin). Port Alfred. Head valve. Ashby Coll. $\times 4$.
41. *Dinoplax gigas* (Gmelin). Same example as No. 40. Median valve. $\times 4$.
42. *Dinoplax gigas* (Gmelin). Same example as No. 40. Tail valve. $\times 4$.
43. *Ischnochiton oniscus* (Krauss). Port Shepstone. Whole shell. Natal Mus. $\times 4\frac{1}{2}$.
44. *Ischnochiton oniscus* (Krauss). Port Alfred. Head valve. Ashby Coll. $\times 4$.
45. *Ischnochiton oniscus* (Krauss). Same example as No. 44. Median valve. $\times 4$.
46. *Ischnochiton oniscus* (Krauss). Same example as No. 44. Tail valve. $\times 4$.
47. *Ischnochiton elizabethensis* Pilsbry. Port Alfred. Head valve. Ashby Coll. $\times 7$.
48. *Ischnochiton elizabethensis* Pilsbry. Same example as No. 47. Median valve. $\times 7$.
49. *Ischnochiton elizabethensis* Pilsbry. Same example as No. 47. Tail valve. $\times 7$.

PLATE V.

50. *Ischnochiton hewitti* n. sp. Table Bay. Holotype. Whole shell. Albany Mus., No. 8085. $\times 4\frac{3}{4}$.
51. *Ischnochiton hewitti* n. sp. Same example as No. 50. Holotype. Head valve. $\times 5\frac{3}{4}$.
52. *Ischnochiton hewitti* n. sp. Same example as No. 50. Holotype. Median valve. $\times 5\frac{3}{4}$.

FIG.

53. *Ischnochiton hewitti* n. sp. Same example as No. 50. Holotype. Tail valve. $\times 5\frac{3}{8}$.
54. *Ischnochiton oniscus alfredensis* n. subsp. Port Alfred. Holotype. Whole shell. Transvaal Mus. $\times 6$.
55. *Ischnochiton ludwigi* ? (Krauss MSS.) Pilsbry. ? Table Bay. Albany Mus. Part of Mus. No. 5078. $\times 5$.
56. *Ischnochiton (Radsella) textilis* (Gray). Saldanha Bay. Head valve. S.A. Mus., No. A5340. $\times 5$.
57. *Ischnochiton (Radsella) textilis* (Gray). Same example as No. 56. Median valve. $\times 5$.
58. *Ischnochiton (Radsella) textilis* (Gray). Same example as No. 56. Tail valve. $\times 5$.
59. *Ischnochiton (Radsella) tigrinus* (Krauss). Port Elizabeth. Head valve. Ashby Coll. $\times 4\frac{1}{8}$.
60. *Ischnochiton (Radsella) tigrinus* (Krauss). Same example as No. 59. Median valve. $\times 4\frac{1}{8}$.
61. *Ischnochiton (Radsella) tigrinus* (Krauss). Same example as No. 59. Tail valve. $\times 4\frac{1}{8}$.
62. *Ischnochiton (Radsella) tigrinus* (Krauss). Same example as No. 59. Whole shell. $\times 4\frac{1}{8}$.

PLATE VI.

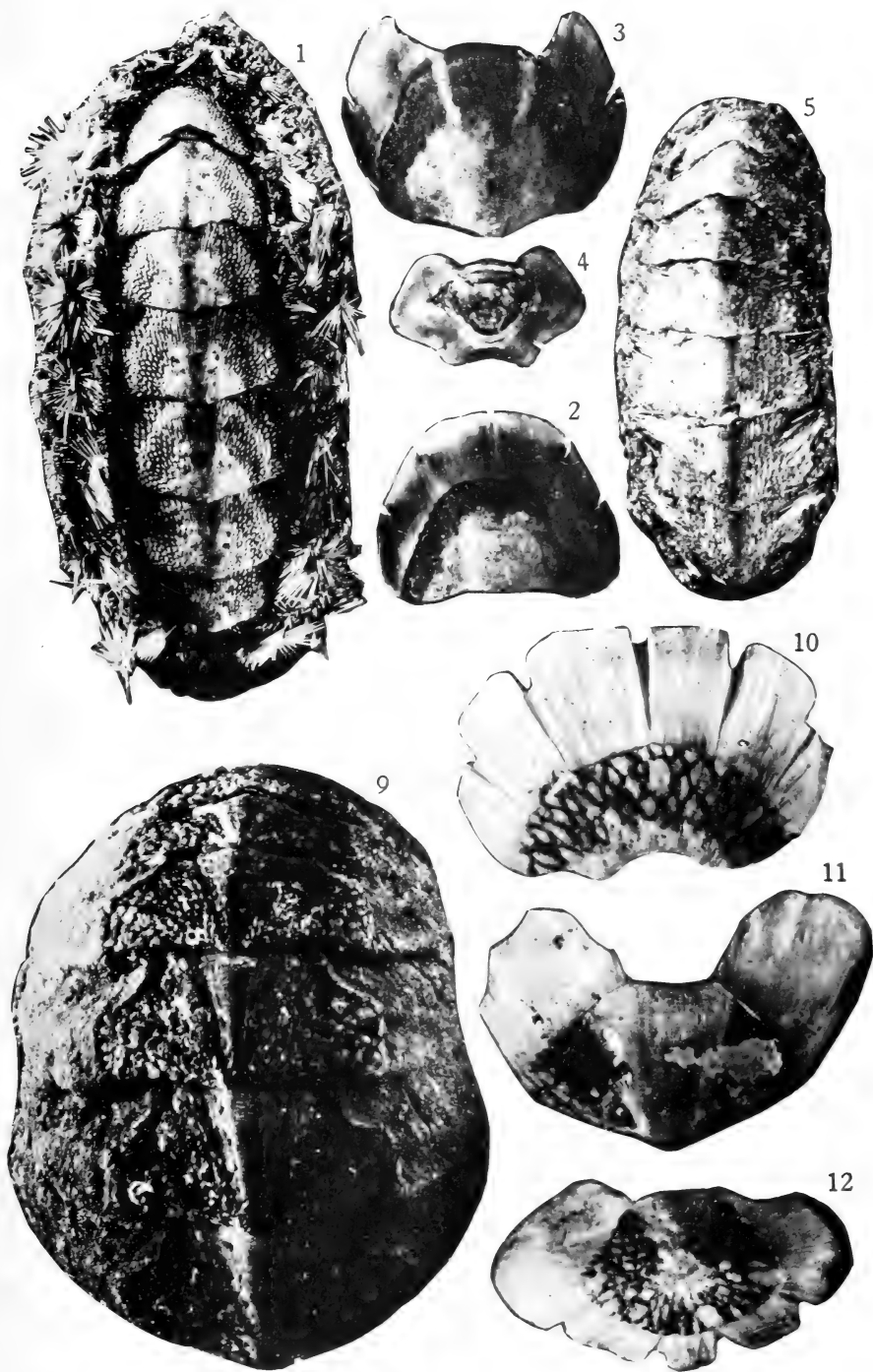
63. *Ischnochiton (Radsella) delagoensis* n. sp. Delagoa Bay. Holotype. Whole shell. S.A. Mus., No. A6589. $\times 7$.
64. *Ischnochiton (Radsella) delagoensis* n. sp. Same example as No. 63. Head valve, broken. $\times 6$.
65. *Ischnochiton (Radsella) delagoensis* n. sp. Same example as No. 63. Median valve. $\times 6$.
66. *Ischnochiton (Radsella) delagoensis* n. sp. Same example as No. 63. Tail valve. $\times 6$.
67. *Chiton tulipa alfredensis* Ashby. Port Alfred. Holotype. Head valve. $\times 4\frac{1}{2}$.
68. *Chiton tulipa alfredensis* Ashby. Same example as No. 67. Median valve, showing longitudinal pitting, which feature alone separates it from typical *C. tulipa*. $\times 4\frac{1}{2}$.
69. *Chiton tulipa alfredensis* Ashby. Same example as No. 67. Tail valve. $\times 4\frac{1}{2}$.
70. *Chiton crawfordi* Sykes. Port Shepstone. Whole shell. Natal Mus. $\times 5$.
71. *Chiton crawfordi* Sykes. Port Shepstone. Head valve. Another example. Natal Mus. $\times 4\frac{1}{2}$.
72. *Chiton crawfordi* Sykes. Same example as No. 71. Median valve. $\times 4\frac{1}{2}$.
73. *Chiton crawfordi* Sykes. Same example as No. 71. Tail valve and part of valve 7 have been welded together, making this example an abnormal seven-valved shell. $\times 4\frac{1}{2}$.
74. *Chiton barnardi* n. sp. Mozambique Is. Paratype. Head valve. S.A. Mus., No. A6590. \times nearly 6.
75. *Chiton barnardi* n. sp. Same example as No. 74. Median valve. \times nearly 6.
76. *Chiton barnardi* n. sp. Same example as No. 74. Tail valve. \times nearly 6.

PLATE VII.

FIG.

77. *Chiton barnardi* n. sp. Mozambique Is. Holotype. Whole shell, curled. S.A. Mus., No. A5331. $\times 7$.
78. *Chiton* (*Sypharochiton*) *nigrovirens* Blainville. Cape. Whole shell. Ashby Coll. $\times 4\frac{1}{2}$.
79. *Chiton* (*Sypharochiton*) *nigrovirens* Blainville. Same example as No. 78. Head valve, slightly damaged. \times nearly 5.
80. *Chiton* (*Sypharochiton*) *nigrovirens* Blainville. Same example as No. 78. Median valve. \times nearly 5.
81. *Chiton* (*Sypharochiton*) *nigrovirens* Blainville. Same example as No. 78. Tail valve. \times nearly 5.
82. *Acanthopleura brevispinosa* (Sowerby). Mozambique Island. S.A. Mus., No. A5330. Portion of photograph of whole shell, curled, showing the calcareous spines of the girdle. $\times 3\frac{1}{2}$.
83. *Onithochiton literatus* (Krauss). Port Shepstone. Whole shell much eroded, but showing concentric grooving of *C. wahlbergi* and longitudinal grooving of *C. literatus* of Krauss. S.A. Mus., No. A5332. $\times 2$.
84. *Onithochiton literatus* (Krauss). Another example from Port Shepstone. Head valve, showing serrate insertion plate. Ashby Coll. $\times 5$.
85. *Onithochiton literatus* (Krauss). Same as example No. 84. Median valve. $\times 5$.
86. *Onithochiton literatus* (Krauss). Same example as No. 84. Tail valve. $\times 5$.

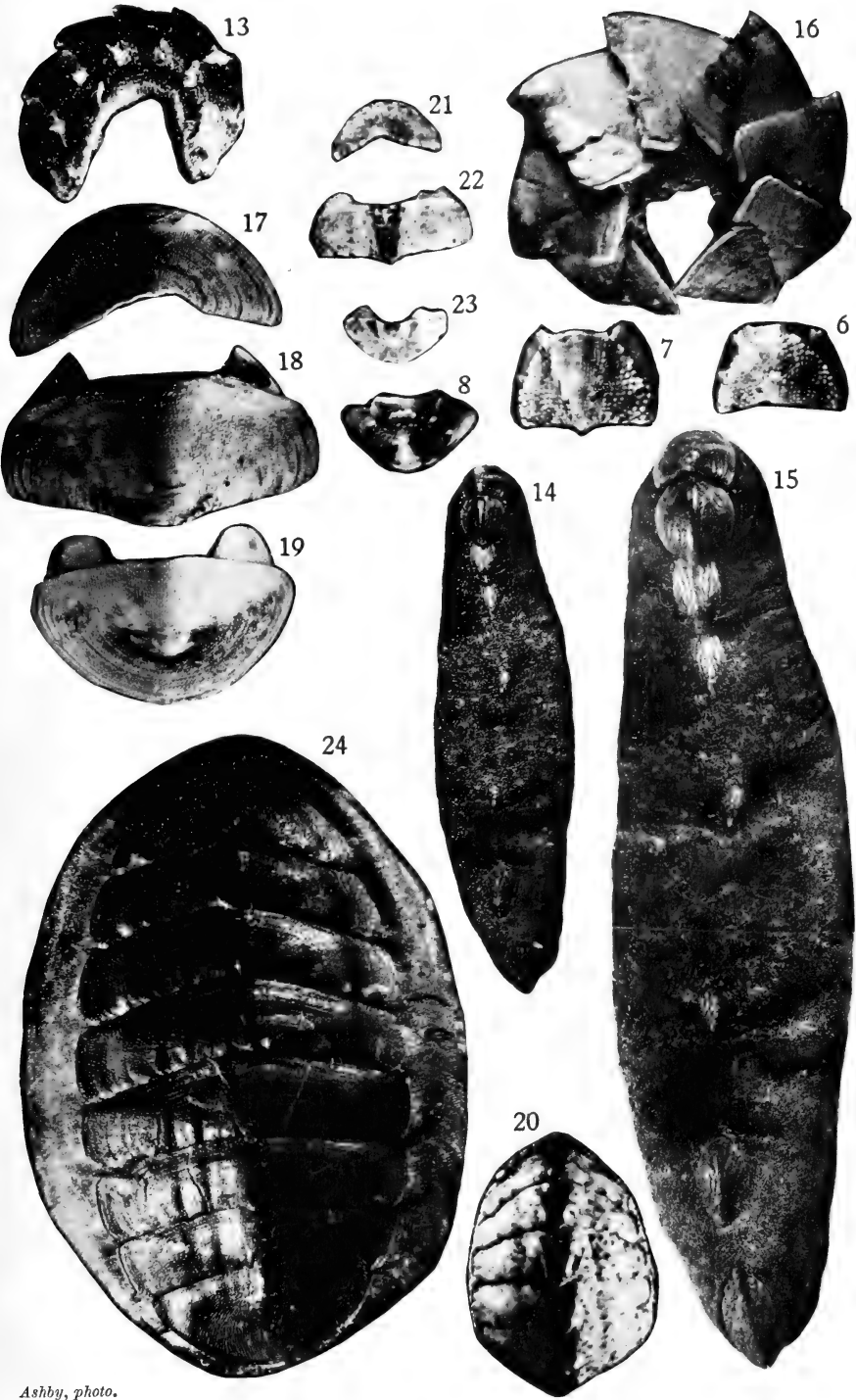
Feb. 17, 1892



Ashby, photo.

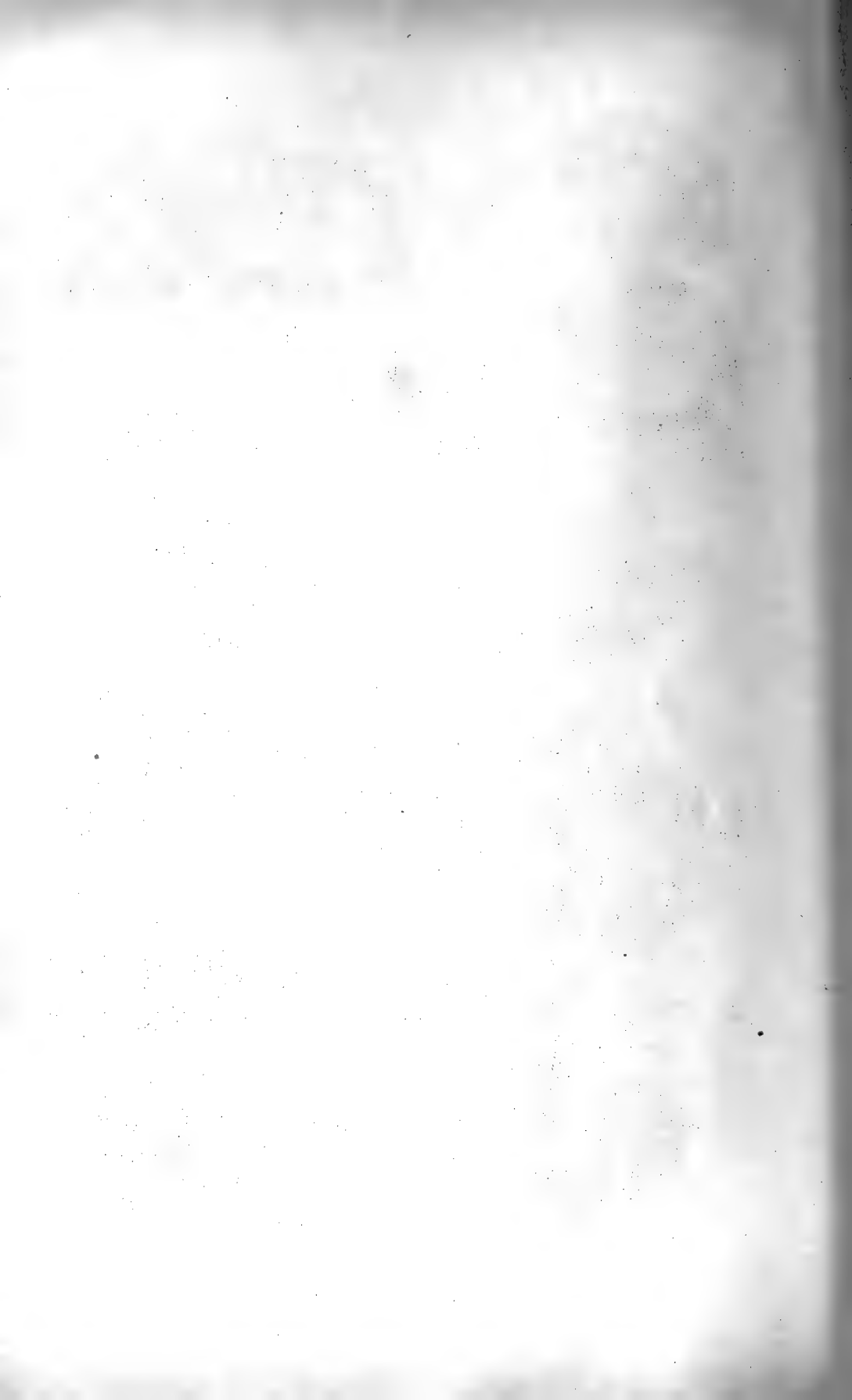
SOUTH AFRICAN CHITONS.

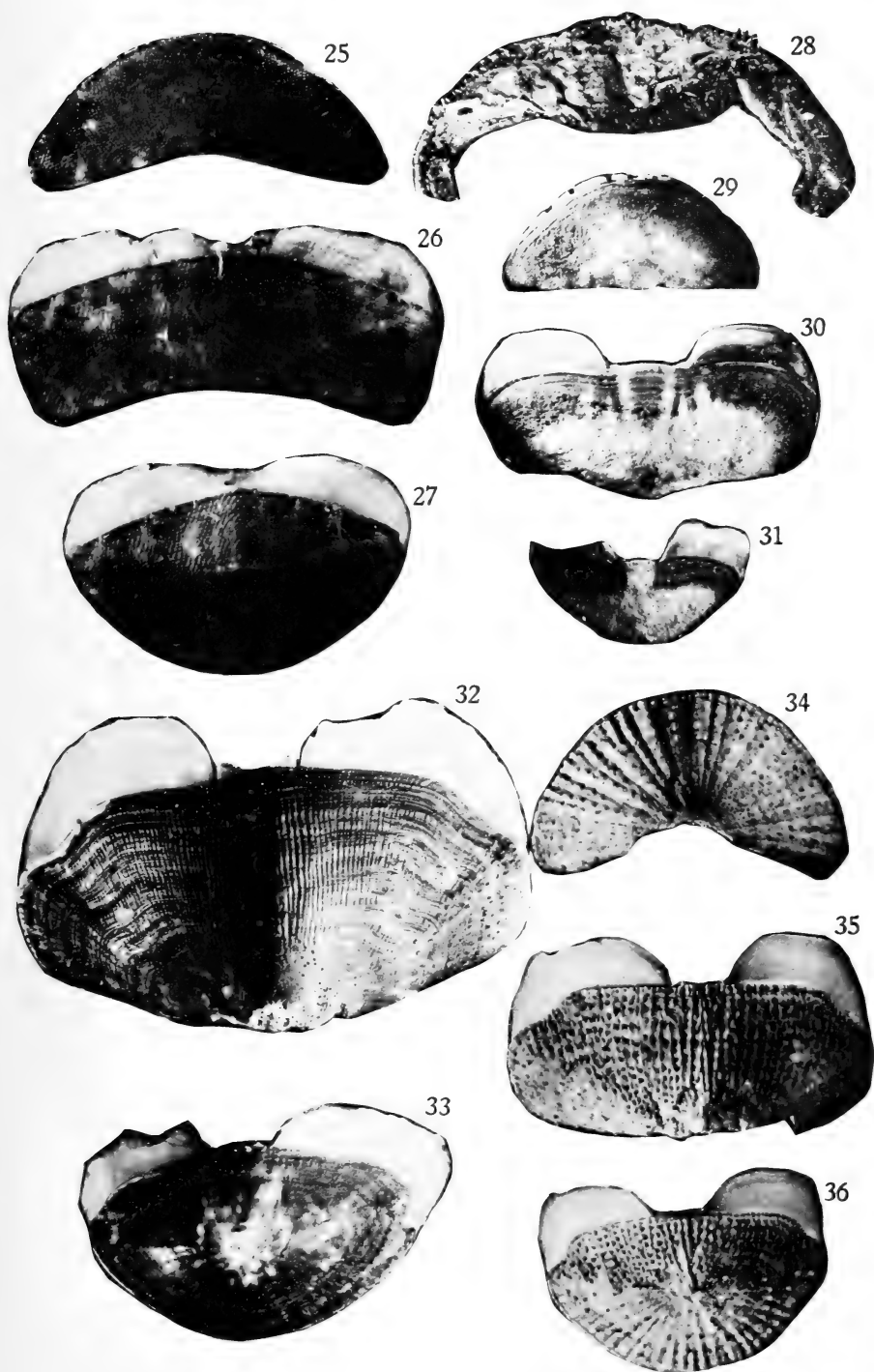




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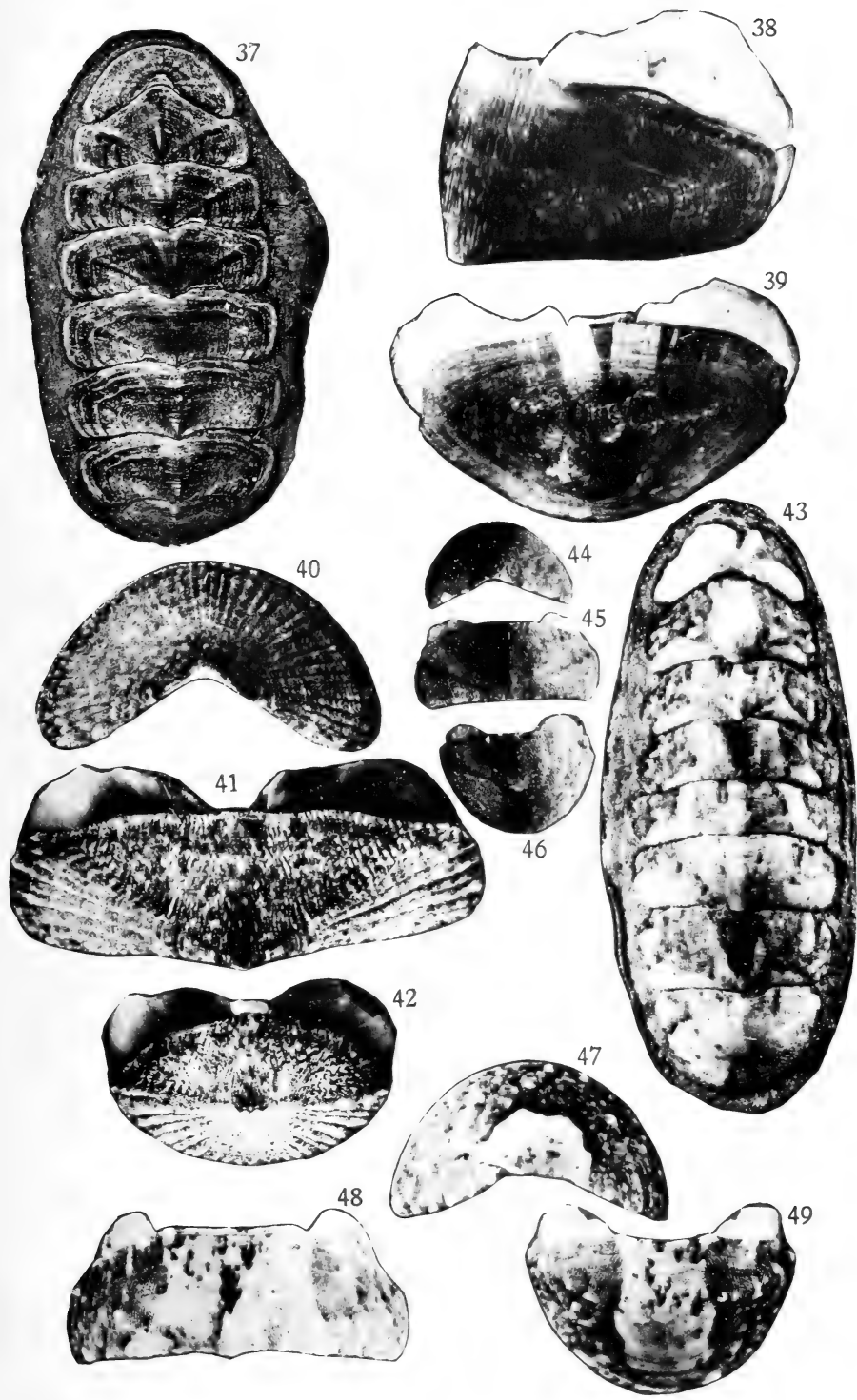
SOUTH AFRICAN CHITONS.





Ashby, photo.

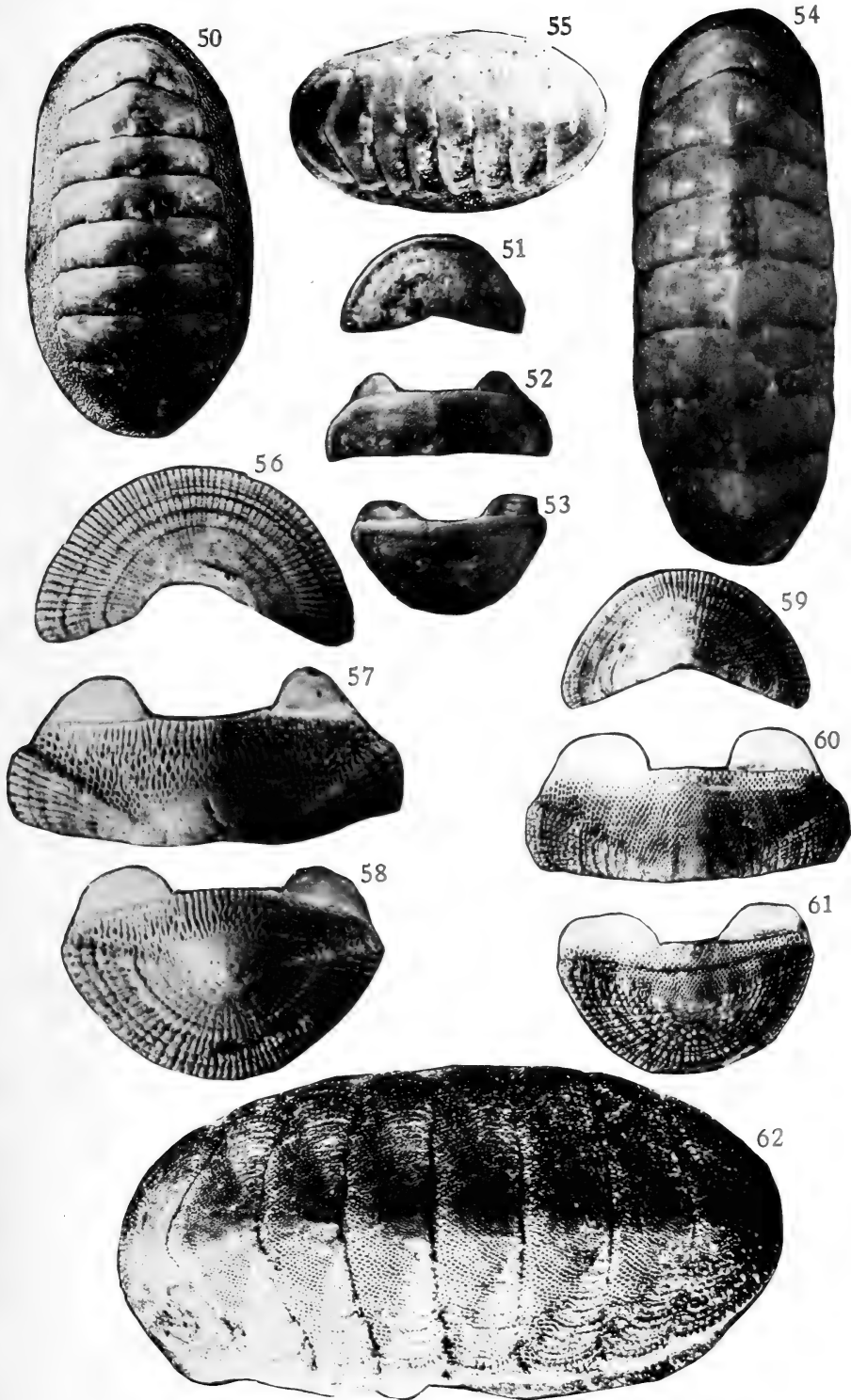




Ashby, photo.

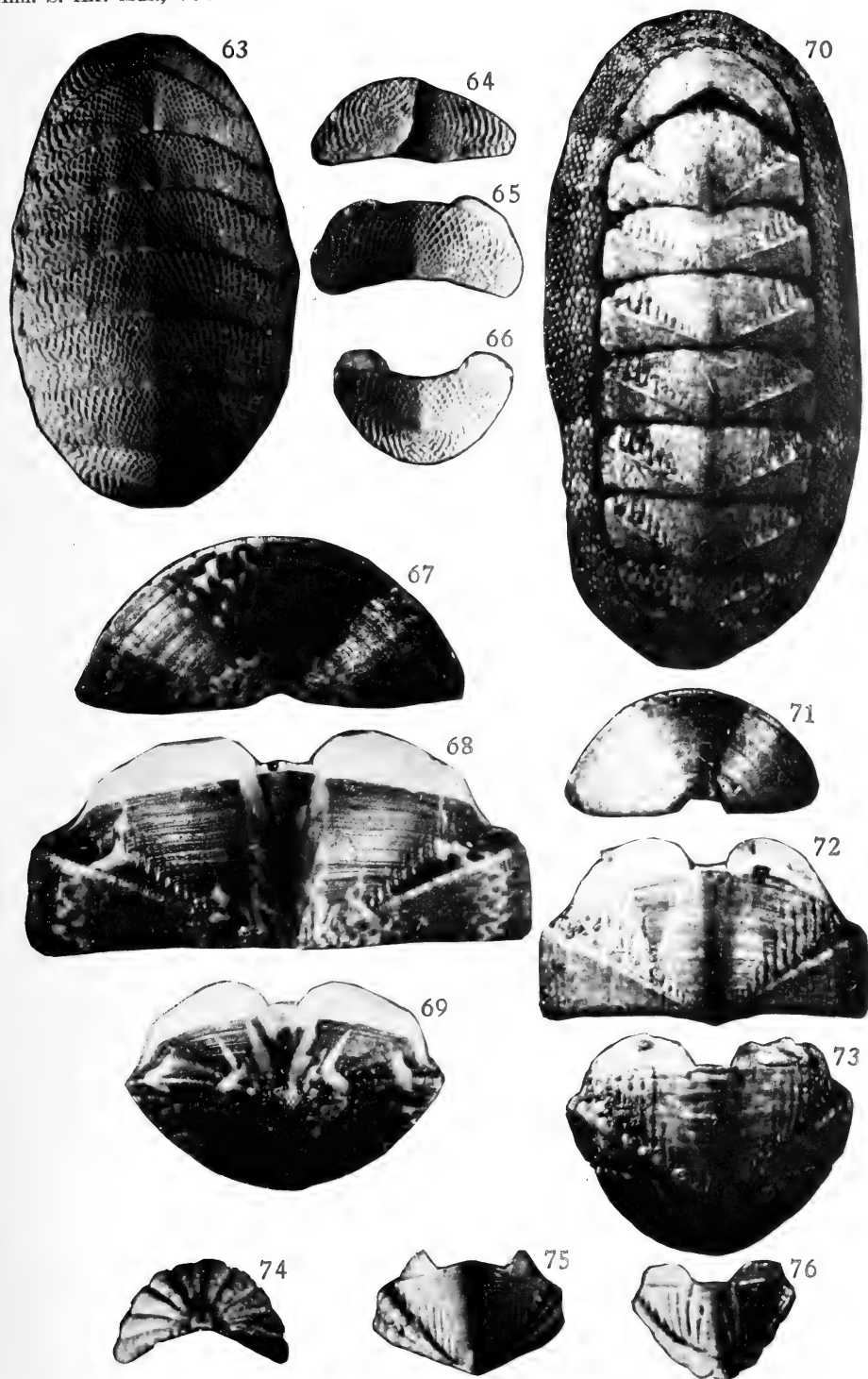
SOUTH AFRICAN CHITONS.





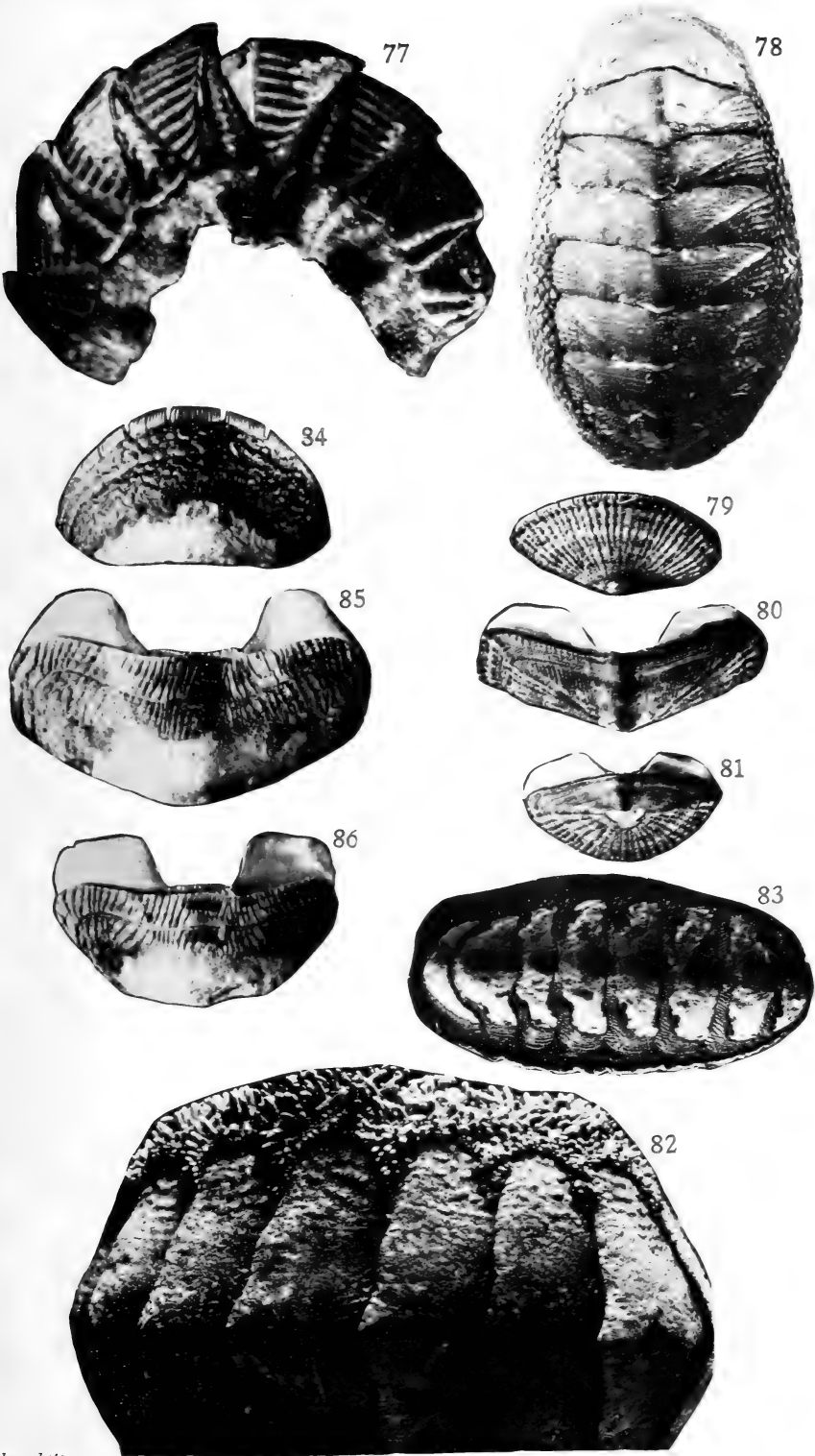
Ashby, photo.





Ashby, photo.





Ashby, photo.

SOUTH AFRICAN CHITONS.



2. *A Contribution to a Knowledge of the South African Japygidae*
(*Insecta, Thysanura*).—By F. SILVESTRI.

(With 24 Text-figures.)

THIS note comprises descriptions of seven species and three varieties of *Japygidae*, of which all but one are new; with the addition of *Parajapyx afer* Silv., they include the two species already known from the region. The list of species and varieties is as follows:—

- Japyx purcelli* Per.
- J. purcelli* var. *gravior* nov.
- J. peringueyi* nov.
- J. gilli* nov.
- J. mallyi* nov.
- J. tragardhi* nov.
- J. barnardi* nov.
- J. barnardi* var. *relata* nov.
- J. fulleri* nov.
- Parajapyx afer* Silv.
- P. afer* var. *transvaalica* nov.

This number must certainly represent only a small proportion of the species to be found in the various parts of the Union, and further collecting is greatly needed to obtain fuller material for determining the affinities of the South African *Japygidae* with those of East and West Africa.

On the basis of the species here described we can divide the South African species of the genus *Japyx* into four groups. To the first group belong *J. purcelli*, *J. peringueyi*, *J. mallyi*, *J. gilli*; to the second *J. tragardhi*; to the third *J. barnardi*; and to the fourth *J. fulleri*. The first two groups are closely related to each other, as are also the third and fourth. When we have more material available for microscopical examination, especially as regards the first urosternite, it will be possible to settle the taxonomic value of this grouping. For the present I prefer to keep all the species under the genus *Japyx*.

I express my thanks to Dr. Leonard Gill, Director of the South

African Museum, for his kindness in sending me for examination the *Japygidae* preserved there, on which this note is principally based.

Japyx purcelli Per.

Figs. 1-3.

? *Japyx capensis* Peringuey in litt. (*nomen nudum*), Bormans, Ann. Soc. ent. Belgique, xxxi (1887), C.R., p. xcv.

Japyx purcelli Peringuey ex parte (♂), Ann. South African Museum, ii (1902), p. 133.

Femina.—Corpus plus minusve obscure ochraceum, abdomine a segmento septimo ferrugineo, segmenti decimi carinis et forcipis marginibus et apice nigrescentibus.

Caput supra setis sat longis c. 12+12 et nonnullis brevibus instructum; antennae 36-(37-) articulate, articulis setis sat longis,

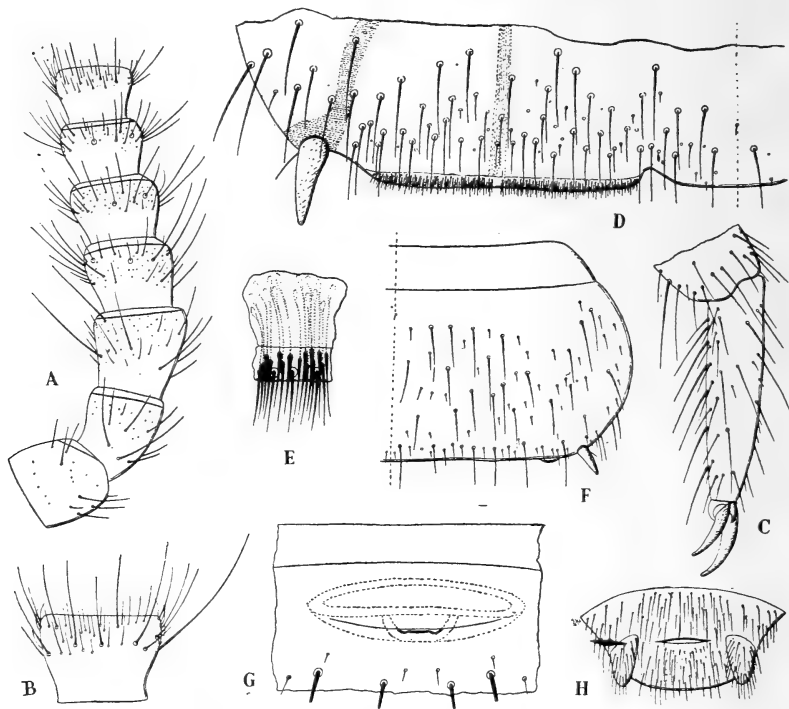


FIG. 1.—*Japyx purcelli*: A, antennae laevae pars proximalis prona; B, ejusdem articulus decimus quintus; C, pes paris tertii a tibiae apice; D, urosterni primi dimidia pars postica; E, ejusdem organi subcoxalis particula magis ampliata; F, urosterni tertii dimidia pars; G, maris urosterni tertii pars antica mediana; H, maris apertura genitalis cum appendicibus.

brevibus et brevioribus ut fig. 1, A, B demonstrant instructis, trichobothriis superis internis sat longis; maxillae primi paris lobus internus laminis pectinatis 5; submentum machrochaetis duabus sat longis et setis nonnullis brevibus et brevioribus instructum.

Thorax: pronotum setis longis et sat longis 5+5, brevibus 3+3, meso-et metanotum praescuto setis paucis brevibus et brevioribus instructo, scuto setis sat longis 6+6 et 5+5 brevibus et brevioribus.

Pedes sat setosi, tarso quam praetarsus magis quam duplo longiore infra setis robustioribus 6+6 instructo, praetarsi ungue postico quam anticus parum longiore, unguicula mediana sat bene evoluta.

Abdomen: tergum primum praescuto eidem metanoti simili, scuto setis duabus submedianis subposticis sat longis; tergita 3-7 setis sat longis 4+4 et paucis brevibus et brevioribus instructa; tergiti sexti angulus posticus rotundatus, septimo in processum breviorum triangularem productus; segmentum octavum quam septimum parum longius et parum angustius lateribus postice rotundatis; segmentum nonum brevius.

Urosternum primum organis subcoxalibus perlatis inter sese tractu parum lato remotis, setis glandularibus brevissimis crebris 1-3 seriatis et serie postica setarum brevissimarum subtiliorum inter sese parum remotis instructis, superficie pone organum subcoxale setis brevibus et brevioribus sat numerosis 2-5 seriatis; urosterni parte mediana postica setis brevissimis 2+2 submedianis, superficie cetera, ut eadem urosternorum sequentium setis sat longis nonnullis traverse 4-seriatis et setis aliis brevioribus et brevissimis parum numerosis instructa.

Stili robusti, seta proximali externa brevior; vesiculae parvae.

Segmentum decimum supra inspectum parum longius quam latius,

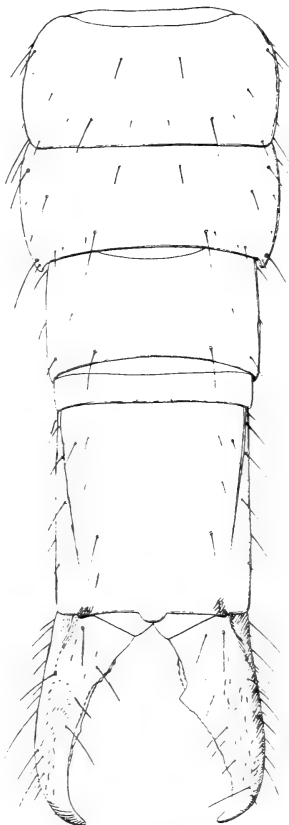


FIG. 2.—*Japyx purcelli*: abdominis pars postica a segmento sexto prona.

carinis aliquantum convergentibus, setis sat longis 6+6 et nonnullis brevissimis instructum, acropygio sat magno, margine super forcipis condylum dorsualem angulatim producto.

Forceps quam segmenti decimi longitudo paulum brevior, brachiis asymmetricis, brachio laevo magis attenuato dente postmedio parvo obtuso, margine proximali tuberculis acutis $\frac{2}{2}$, pone tubercula

dicta margine parum sinuato tuberculis perparvis $\frac{9}{12}$, margine postdentali vix crenulato, brachio dextero dente praemediano magno acuto, margine praedentali tuberculis $\frac{3}{4}$ vel $\frac{4}{4}$ tuberculo primo supero perparvo, margine postdentali fere usque ad apicem paulum profunde crenulato.

Papillae genitales laterales setis brevissimis 13-14 instructae.

Mas.—Urosterni tertii pars mediana antica ad praesternum fovea lata transversali subelliptica margine mediano postico sinum brevem formante ab urosterni superficie laminari fere omnino operculatum.

Appendices genitales subconicae, breviores, persetosae.

Long. corporis ad 20 mm., lat. urotergiti septimi 2.35 mm., long. antennarum 5 mm., forcipis 1.8 mm.

Juvenis (fig. 3).—Long. corporis 6.5 mm. lat. urotergiti septimi .65 mm.

Antennae 36-articulatae.

Urotergitum septimum angulo postico haud producto.

Urosternum primum organis subcoxalibus parvis inter sese unius latitudine remotis setis glandularibus brevissimis uniseriatis inter sese basi approximatis et serie postica setarum brevissimarum subtiliorum minus numerosis instructa.

Forcipis brachium laevum dente postmedio sat magno, margine praedentali tuberculis $\frac{5}{7}$, brachium laevum margine praedentali tuberculis $\frac{2}{3}$.

Habitat.—Africa Australis: Exempla hic descripta clar. K. H. Barnard ad Platteklop, Table Mt., Cape Town legit et alia ad Noordhoek Forest (Cape Peninsula); inter exempla quatuor a clar. W. F. Purcell lecta tria antennis 37-articulatas habent. Ego ipse exempla quatuor legi in humo ad Stellenbosch (Cape Province).

Observatio.—Speciei huius exempla ex viciniis Capetown antennis 36-articulatis typica retineo, cetera a Peringuey ad eandem relata, antennis 42-articulatis instructa, referenda sunt ad *Japyx peringueyi*.

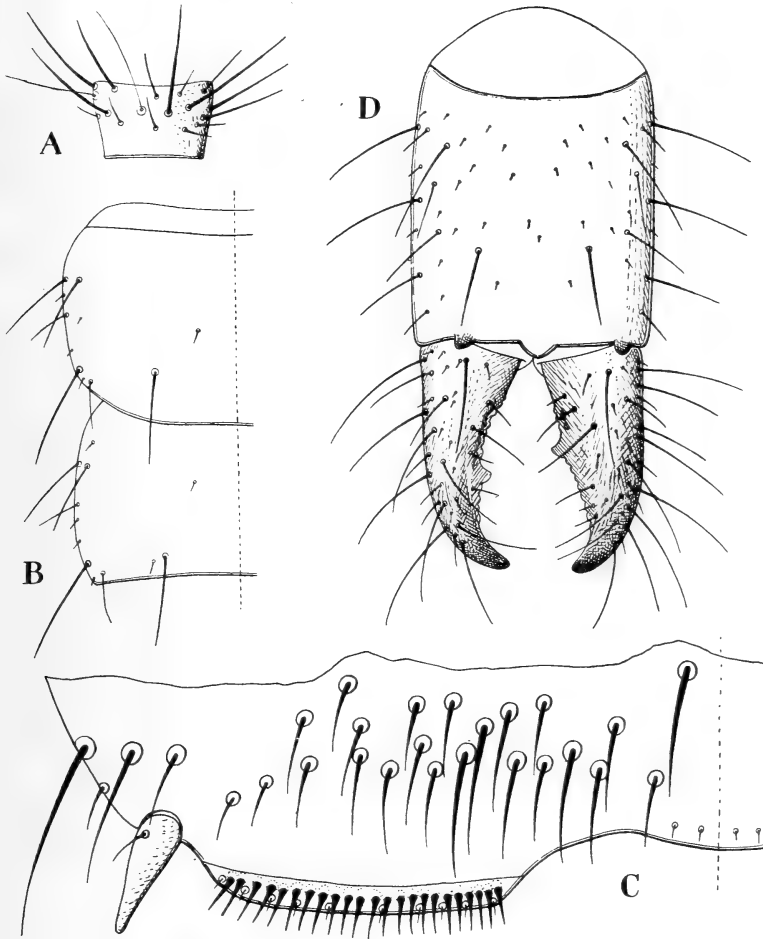


FIG. 3.—*Japyx purcelli*, juvenis: A, antennae laevae articulus quintus pronus; B, urotergitorum sexti et septimi dimidia pars prona; C, urosterni dimidia pars postica; D, abdominis segmentum decimum pronum cum forcipe.

Japyx purcelli Per. var. *gravior* nov.

Figs. 4, 5.

Exempla vidi duo ad River Zonder End Mts., a clar. K.H. Barnard, quae a forma typica differunt characteribus sequentibus.

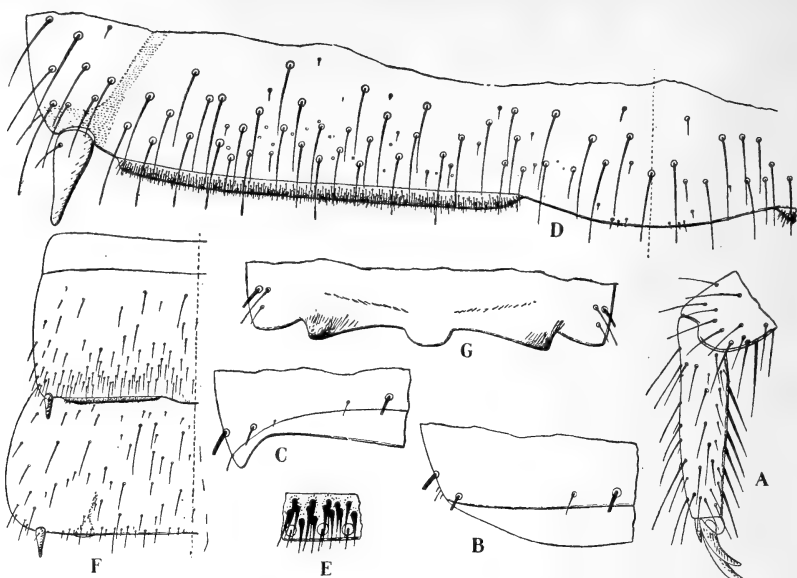


FIG. 4.—*Japyx purcelli* var. *gravior*: A, pes parvis tertii a tibiae apice; B, tergiti sexti pars lateralis postica; C, tergiti septimi pars lateralis postica; D, urosterni primi pars mediana postica; E, ejusdem organi subcoxalis particula magis ampliata; F, urosternorum primi et secundi dimidia pars; G, abdominis segmenti decimi pars postica dorsualis.

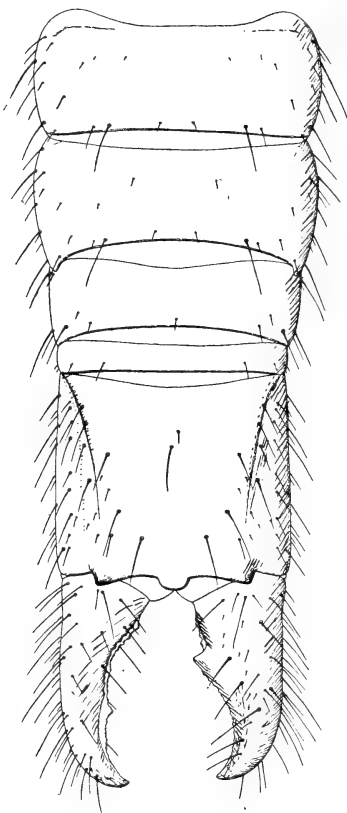


FIG. 5.—*Japyx purcelli* var. *gravior*: abdominis pars postica a segmento sexto prona.

Antennae 38-articulatae.

Segmentum decimum abdominale supra mensum parum latius quam longius.

Forcipsis brachii dexteri dens proximalis magnus (major quam formae typicae).

Long. corporis ad 24 mm., lat. urotergiti septimi 2.90 mm., long. antennarum 6 mm., forcipis 2.1 mm.

Japyx peringueyi sp. n.

Figs. 6, 7.

? *Japyx purcelli* Peringuey ♀, Ann. South African Museum, ii (1902), p. 134.

Mas.—Corpus ochraceum abdomine a segmento octavo ferrugineo carinis et forcipis marginibus et apice nigrescentibus.

Caput supra setis sat longis c. 15+15 et aliis magis numerosis

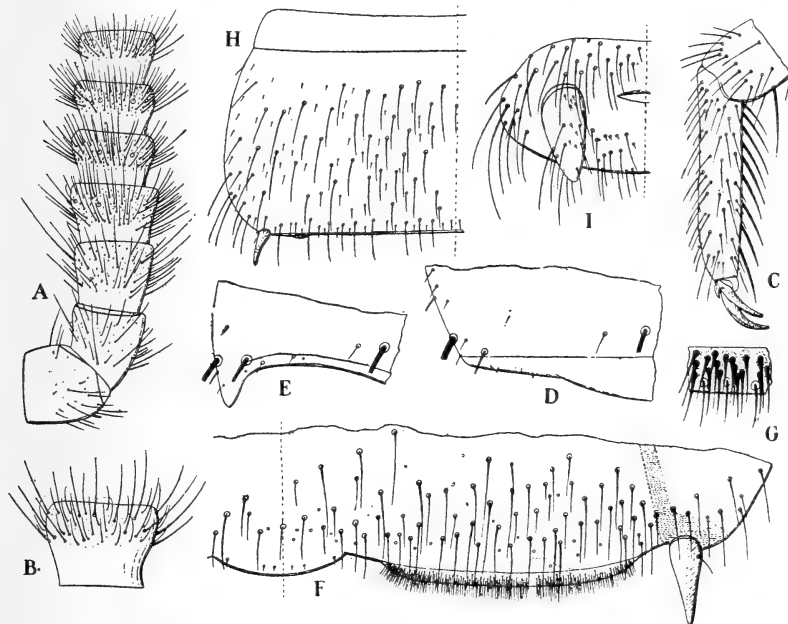


FIG. 6.—*Japyx peringueyi*: A, antennae laevae pars proximalis prona; B, ejusdem articulus decimus secundus; C, pes paris tertii a tibiae apice; D, urotergiti sexti pars postica lateralis; E, urotergiti septimi pars postica lateralis; F, urosterni primi dimidia pars postica; G, ejusdem organi subcoxalis particula magis ampliata; H, urosterni tertii dimidia pars; I, maris regionis genitalis dimidia pars.

brevibus et brevioribus instructum; antennae 44-articulatae (antenna altera exempli alius 45-articulata) articulis setis longis usque ad articulum tertium brevibus et brevioribus ut fig. 6, A, B demonstrant,

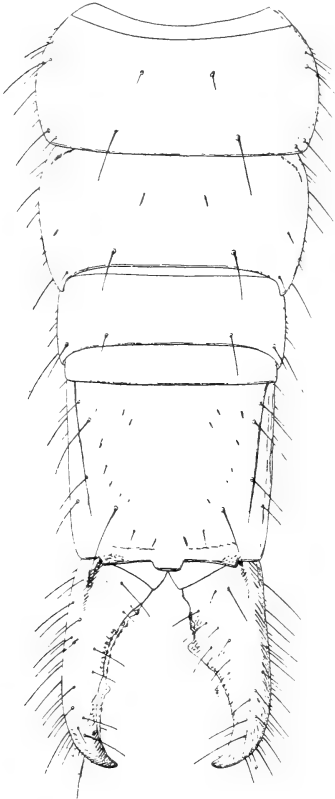


FIG. 7.—*Japyx peringueyi*: abdominis pars postica a segmento sexto prona.

trichobotriis superis internis parum longis, maxillae primi paris lobus internus laminis pectinatis 5 instructus, palpus labialis .24 mm. longus, setis nonnullis brevibus instructus.

Thorax: pronotum setis longis 5+5, brevibus et brevioribus 12+12 instructum; mesonotum praescuto setis brevibus 3+3, scuto setis longis 8+8, brevibus et brevioribus 14+14, metanotum praescuto setis brevibus 1+1 submedianis, scuto setis longis 7+7.

Pedes tarso quam praetarsus fere triplo longiore infra setis robustioribus 9+9 instructo, praetarsi ungue postico quam anticus paulum longiore.

Abdomen: tergum primum praescuto eidem metanoti simili, scuto setis duabus submedianis sat longis subposticis; tergita 3-7 setis longis 4+4 et brevibus et brevioribus c. 10+10 instructa, tergiti sexti angulus posticus rotundatus, septimi in angulum brevem angustum subobtusum productus; tergum octavum quam septimum parum brevius et parum

angustius lateribus postice haud productis; tergum nonum brevius.

Urosternum primum organis subcoxalibus inter sese unius latitudine remotis setis grandularibus brevissimis 2-3 inordinatim seriatis et serie postica setarum brevissimarum subtiliorum instructis, superficie pone organum subcoxale setis sat numerosis brevibus et brevioribus 2-4 inordinatim seriatis, urosterni parte postica mediana setis minimis 2+2 instructa, urosterni superficie cetera setis nonnullis sat longis transverse 4-seriatis et setis magis numerosis brevioribus et brevissimis.

Stili et vesiculae consueta.

Segmentum decimum supra inspectum paulum latius quam longius carinis distinctis setis sat longis 6+6 et setis nonnullis brevissimis instructum, acropygio latiusculo, angulo externo supracondyloideo acuto.

Forceps robusta, segmenti decimi latitudinem subaequans, brachiis asymmetricis, brachio laevo dente postmediano sat magno, margine praedentali aliquantum sinuato tuberculis $\frac{9}{10}$, margine postdentali parum profunde crenulato, brachio dextero dente proximali magno, margine praedentali denticulis $\frac{3}{3}$, margine postdentali parum profunde crenulato.

Appendices genitales subconicae.

Long. corporis ad 20 mm., lat. urosterni septimi 2.48 mm., long. antennarum 6 mm., forcipis 1.7 mm.

Habitat.—Exempla duo typica clar. K. H. Barnard ad Waaihoek Kloof, Goudini (apud Worcester) legit et in Museo Capense asservata.

Observatio.—Species haec, in memoriam clar. L. Peringuey dicata, a *J. purcelli* Per. antennarum articulorum numero, earumdem articulis a quarto setis longis destitutis, urosterni organo subcoxali minus lato, maris urosterno tertio fovea antica destituto facile distinguenda est.

Japyx gilli sp. n.

Figs. 8, 9.

Mas.—Corpus ochraceum abdomine a segmento septimo ferrugineo, forcipis apice et marginibus nigrescentibus.

Caput supra setis nonnullis brevibus et aliis brevioribus (in exemplo typico maxima pro parte abruptis) instructum; antennae: laeva 24-articulata sed apice certe anormali, dextera? (in exemplo typico haud integra); setis ut fig. 8, A-C, demonstrant, trichobothriis superis internis parum longis; maxillae primi paris lobus internus laminis pectinatis 5 instructus; palpus labialis elongatus $\frac{2}{5}$ longus, submenti macrochaetae quam ejusdem latitudo c. $\frac{2}{5}$ breviores.

Thorax: pronotum setis sat longis 3+3 et nonnullis brevioribus; meso-et metanotum praescuto setis nonnullis brevibus, scuto setis sat longis 5+5 et nonnullis brevibus (in exemplo typico maxima pro parte abruptis).

Pedes bene setosi tarso quam praetarsus aliquantum magis quam

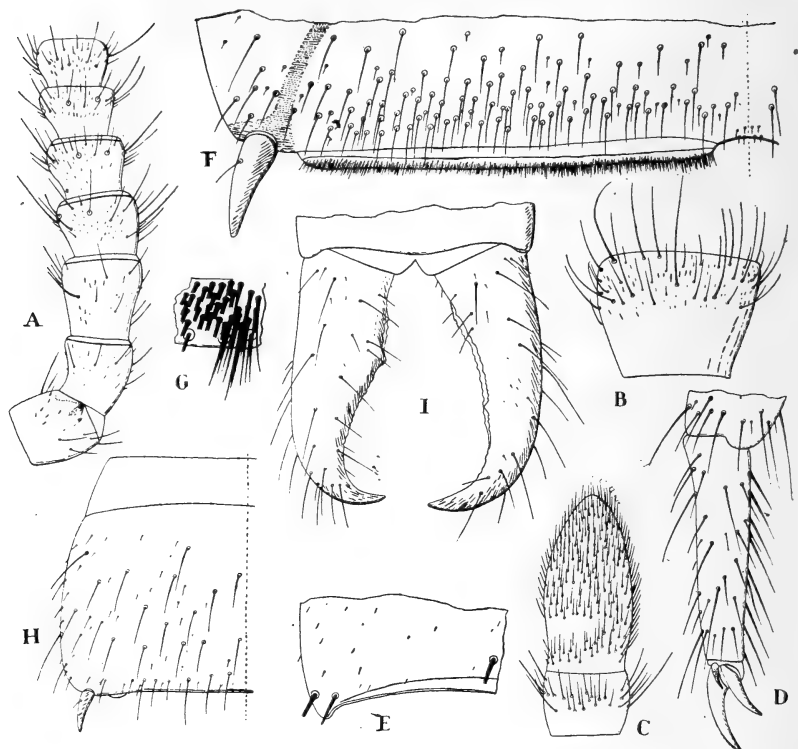


FIG. 8.—*Japyx gilli*: A, antennae laevae pars proximalis prona; B, articulus decimus secundus; C, antennae laevae pars apicalis anormalis; D, pes paris tertii a tibiae apice; E, urotergiti septimi pars lateralis postica; F, urosterne primi dimidia pars postica; G, ejusdem organi subcoxalis particula magis ampliata; H, urosterne tertii dimidia pars; I, segmenti decimi pars postica cum forcipe supina.

duplo longiore infra setis 8+8 robustioribus instructo, praetarsi ungue postico quam anticus aliquantum longiore, unguicula mediana bene evoluta.

Abdomen: tergatum primum praescuto eidem metanoti simili, scuto setis duabus submedianis posticis et setis nonnullis brevibus instructo, tergita 3-7 setis sat longis 4+4 et nonnullis brevibus instructa; tergiti sexti angulus posticus rotundatus, septimi in processum brevioris subconicum productus; ejusdem tergiti lateribus parum convergentibus; segmentum octavum quam septimum parum longius et parum angustius angulo laterali postico rotundato, segmentum nonum brevius.

Urosternum primum organis subcoxalibus perlatis inter sese brevi tractu remotis, setis glandularibus brevissimis crebris 3-5 inordinatim

transverse seriatis et serie postica setarum brevissimarum subtiliorum, superficie pone organum subcoxale setis numerosis brevibus 3-5 inordinatim seriatis, urosterni margine postico mediano setis brevissimis 4+4 instructo, urosterni superficie cetera setis minus brevibus parum numerosis transverse 5-seriatis instructa.

Stili et vesiculae consueta.

Appendices genitales breves subcylindraceae, paullum attenuatae apice convexo persetosae.

Segmentum decimum supra inspectum paullum longius quam latius, carinis distinctis, setis 7+7 sat longis et nonnullis brevibus (in exemplo typico maxima pro parte abruptis), acropygio lato, brevi, postice late rotundato.

Forceps quam segmenti decimi latitudo parum longior, brachiis parte distali subunciformi, brachio laevo dente postmediano (fig. 8, 1, et 9) perparvo, margine praedentali tuberculis perparvis $\frac{8}{10}$, mar-

gine postdentali tuberculis perparvis $\frac{3}{7}$,

brachio dextero dente praemediano sat magno, margine praedentali tuberculis $\frac{3}{4}$,

margine postdentali paullum profunde crenulato.

Long. corporis 18 mm., lat. urotergiti septimi 2.22 mm., long. antennarum 4.5 mm., forcipis 1.9 mm.

Habitat.—Capetown: exemplum typicum tantum vidi a clar. R. W. E. Tucker lectum et in Museo Capensi asservatum.

Observatio.—Species haec, quam animo grato clar. Dr. Leonard Gill dico, forcipis forma ab affinibus (*J. purcelli*, *J. perigueyi*) distinctissima est.

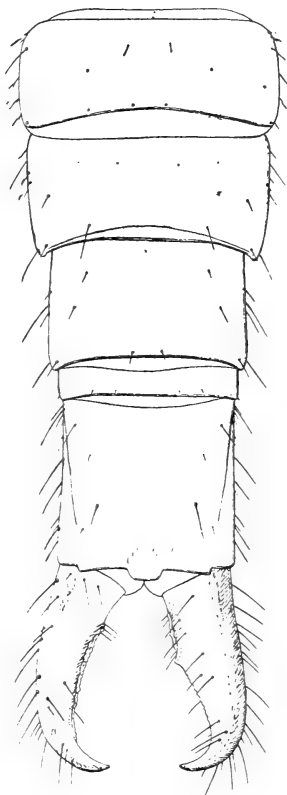


FIG. 9.—*Japyx gilli*: abdominis pars postica a segmento sexto prona.

Japyx mallyi sp. n.

Figs. 10, 11.

Mas.—Corpus ochroleucum ab abdominis segmento octavo pallide ferrugineum forcipis marginibus badiis.

Caput supra setis brevioribus numerosis et paucis brevibus instructum; antennae 42-articulatae, articulis setis longis, brevibus et

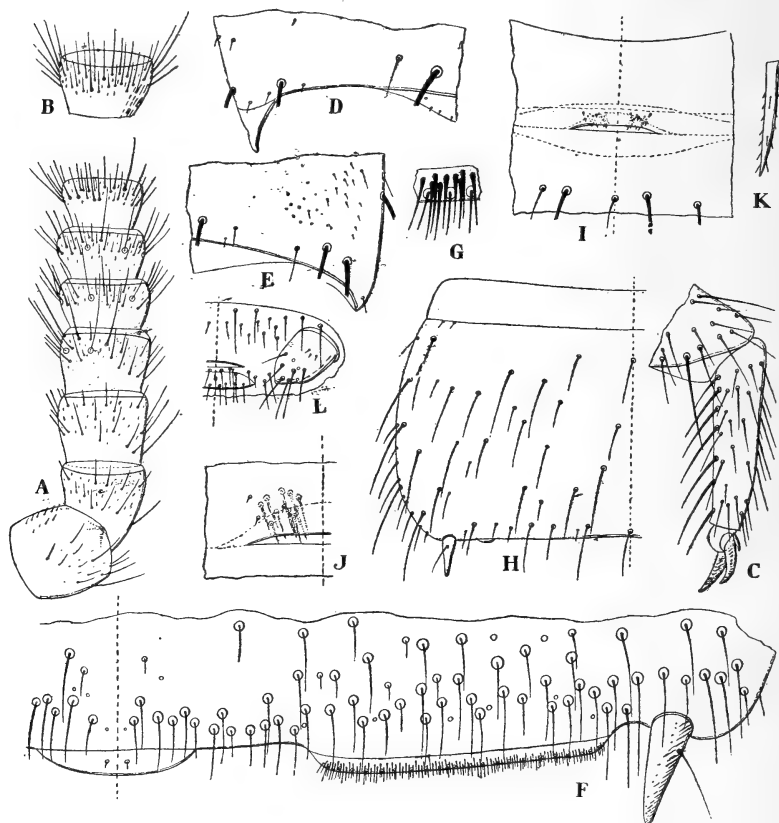


FIG. 10.—*Japyx mallyi*: A, antennae laevae pars proximalis prona; B, ejusdem articulus vigesimus; C, pes paris tertii a tibiae apice; D, urotergiti septimi pars postica lateralis; E, urotergiti octavi pars postica lateralis; F, urosterniti primi dimidia pars postica; G, ejusdem organi subcoxalis particula magis ampliata; H, urosterni quinti dimidia pars; I, maris urosterni tertii pars mediana antica; J, ejusdem foveae dimidia pars magis ampliata; K, ejusdem foveae seta magis ampliata; L, maris regionis genitalis dimidia pars.

brevioribus ut fig. 10, A, B demonstrant instructis, trichobothriis superis internis parum longis, maxillae primi paris laminis pectinatis 5, palpus labialis 1.3 mm. longus.

Thorax: pronotum seta 1+1 sat longa, 4+4 brevibus et setis sat numerosis brevioribus instructum; meso-et metanotum praescuto setis duabus submedianis brevibus et nonnullis brevioribus, scuto setis 6+6 longis et sat longis (5+5 per metanotum) et setis sat numerosis brevioribus instructo.

Pedes tarso quam praetarsus aliquantum magis quam duplo longiore, praetarsi ungue postico quam anticus parum longiore, unguicula mediana bene evoluta.

Abdomen: tergum primum praescuto eidem metanoti simili, scuto setis duabus subposticis sublateralibus parum brevibus et setis sat numerosis brevioribus instructo; terga 3-7 setis sat longis et setis brevioribus paucis instructa; tergum sexti angulo postico postice rotundato, septimi in processum brevem angustum producto; tergum octavum septimum longitudine subaequans et quam idem parum angustius, lateribus postice acute aliquantum productis; tergum nonum brevius.

Urosternum primum organum subcoxalibus inter sese unius latitudine remotis, setis glandularibus brevissimis numerosis, crebris 1-2 seriatis et serie setarum subtiliorum brevissimarum inter sese parum remotis instructis, superficie pone organum subcoxale setis brevibus inordinatim 2-4 seriatis et poris paucis sparsis, urosterni parte postica mediana setis minimis duabus medianis, urosterni superficie cetera ut urosternum sequentium setis sat longis parum numerosis (praesterni serie exclusa) 3-seriatis et setis nonnullis brevioribus.

Stili seta proximali stili apicis libellam fere attingente; vesiculae parvae, bene distinctae.

Appendices genitales conicae, breviores.

Segmentum decimum supra inspectum subaequae longum atque

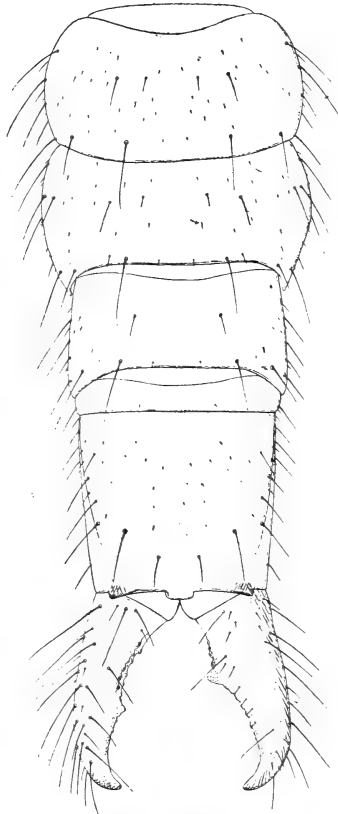


FIG. 11.—*Japyx mallyi*: Abdominis pars postica a segmento sexto.

latum carinis distinctis, setis longis 6+6 et aliis brevibus et brevissimis magis numerosis instructum, acropygio lato, brevissimo.

Forceps segmenti decimi latitudo subaequans, brachio laevo dente aliquantum postmediano sat magno, margine praedentali aliquantum sinuato tuberculis $\frac{6}{6}$, margine postdentali paullum profunde crenulato, brachio dextero dente aliquantum praemediano magno, margine praedentali tuberculis $\frac{3}{3}$, margine postdentali parum profunde crenulato.

Long. corporis ad 14 mm., lat. urotergiti septimi 1.7 mm., long. antennarum 3.2 mm., forcipis 1.15 mm.

Habitat.—East London: exemplum typicum a R. M. Lightfoot lectum et in Museo Capense asservatum.

Observatio.—Species haec, amicissime clar. C. W. Mally dicata, a *J. purcelli* Per. antennarum articulorum numero, urosterni primi organo subcoxali minus lato, urotergiti septimi angulo postico angustiore distincta est.

Japyx tragardhi sp. n.

Figs. 12, 13.

Japyx purcelli Silv. nec Peringuey, Arkiv f. Zoologi, viii (1913), No. 1, p. 7, fig. vi.

Femina.—Corpus ochroleucum abdomine a segmento octavo badio-ferrugineo, segmenti decimi carinis et forcipis marginibus et apice nigrescentibus.

Caput supra setis brevibus c. 15+15 et aliis parum magis numerosis brevioribus instructum; antennae 33-articulatae, articulis setis longis, brevibus et brevioribus ut fig 12, A, B demonstrant instructis, trichobothriis superis internis parum longis; maxillae primi paris laminae pectinatis 5; submentum macrochaetis duabus sat longis et setis nonnullis brevibus et brevioribus instructum.

Thorax: pronotum setis longis et sat longis 5+5 et nonnullis brevioribus, mesonotum praescuto setis duabus submedianis sat longis et nonnullis brevissimis, scuto setis sat longis 7+7 et nonnullis brevibus et brevioribus instructo, metanotum scuto setis sat longis 5+5.

Pedes sat setosi, tarso quam praetarsus duplo longiore infra setis robustioribus 4+4 instructo, praetarsi ungue postico quam anticus aliquantum longiore unguicula mediana bene evoluta.

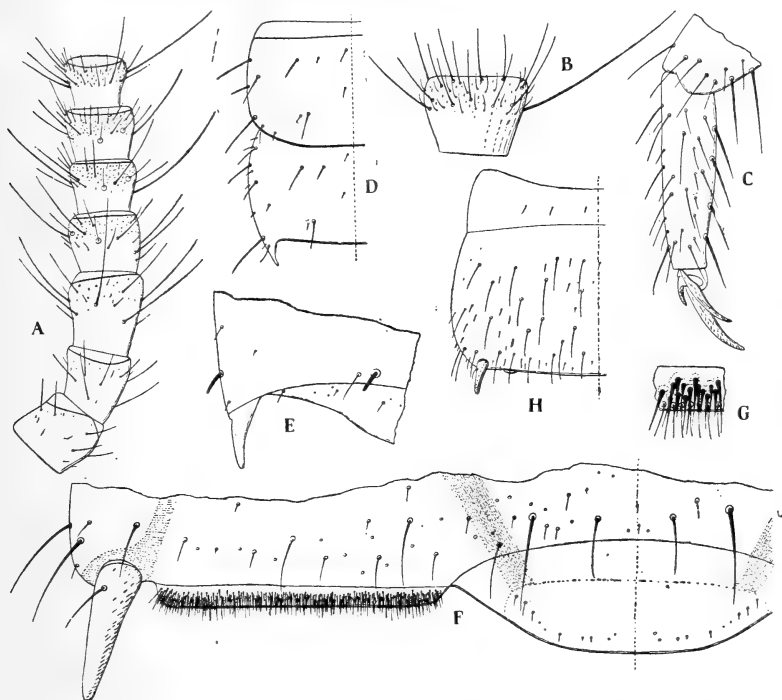


FIG. 12.—*Japyx tragardi*: A, antennae laevae pars proximalis prona; B, ejusdem articulus vigesimus; C, pes paris tertii a tibiae apice; D, urotergitorum sexti et septimi dimidia pars; E, urotergiti septimi pars postica lateralis magis ampliata; F, urosterni primi dimidia pars postica; G, ejusdem organi subcoxalis particula magis ampliata; H, urosterni quarti dimidia pars.

Abdomen: tergum praescuto eidem metanoti et mesonoto simili, scuto setis duabus sat longis submedianis subposticis et setis nonnullis brevioribus et brevissimis; tergita 3-7 setis sat longis 6+6 et setis nonnullis brevioribus et brevissimis instructa; tergiti sexti angulus posticus rotundatus, septimi in processum longum angustum acutum productus; tergum octavum quam septimum parum brevius et quam idem parum magis angustius lateribus postice haud productis; tergum nonum brevius.

Urosternum primum organis subcoxalibus parum latis inter sese magis quam unius latitudo remotis, setis glandularibus brevissimis 1-3 inordinatim seriatis et setis brevissimis subtilioribus posticis uniseriatis instructis, superficie pone organum subcoxale setis brevioribus 5, uniseriatis et 3 brevibus, nec non poris glandularibus minimis paucis instructa, urosterni parte mediana postica organo glandulari lato (·26 mm.) subelliptico setis minimis 6+6 et poris minimis 4+4

(an semper ?) instructo, urosterni superficie cetera ut eadem uroster-
norum sequentium (fig. 12, H) setis parum brevibus nonnullis trans-
verse 4-seriatis et setis minimis spar-
sis aucta.

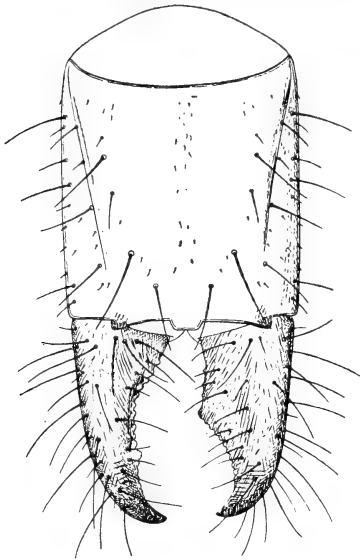


FIG. 13.—*Japyx tragardhi*: abdo-
minis segmentum decimum cum
forcepe pronum.

Stili et vesiculae consueta.

Segmentum decimum supra in-
spectum subaeque longum atque
latum carinis convergentibus setis
longis 8+8, nonnullis brevibus et
aliis sat numerosis brevissimis in-
structum, acropygio sat magno pos-
tice parum sinuato, margine postico
supra forcipis condylum dorsualem
angulatim aliquantum producto.

Forceps quam segmenti decimi
latitudo paulum brevior, brachiis
asymmetricis, brachio laevo dente
aliquantum postmediano parvo ob-
tuso, margine praedentali aliquan-

tum sinuato tuberculis $\frac{6}{10}$ instructo,

margine postdentali fere usque ad
apicem crenulato, brachio dextero

dente praemediano magno subacuto, margine praedentali denticulis
tribus, margine postdentali fere usque ad apicem crenulato.

Long. corporis ad 15 mm., lat. urotergiti septimi 1.7 mm., long.
antennarum 3.2 mm., forcipis 1.2 mm.

Habitat.—Exempla duo Dr. I. Trägårdh ad Sweet-Waters (Natal)
legit.

Observatio.—Species haec clar. Dr. I. Trägårdh amicissime
dicata, a *J. purcelli* Per. antennarum articulorum numero, urotergiti
septimi angulo postico, urosterni primi organo glandulari mediano
postico et forcipis brachio dextero denticulis praedentalibus tantum
uniseriatis multo distincta est.

Japyx barnardi sp. n.

Figs. 14, 15.

Corpus stramineum abdominis a segmento octavo ochroleuco
forcipis marginibus badiis.

Caput supra setis brevibus c. 15+15 instructum; antennae

26-articulatae, articulis setis longis brevioribus et brevibus ut fig. 14, A, B demonstrant instructis, trichobothriis superis internis sat longis ; maxillae primi paris laminis pectinatis 5, palpus labialis .09 mm. longus.

Thorax : pronotum setis longis et sat longis 5+5, meso-et metanotum praescuto setis duabus submedianis sat longis et duabus sub-

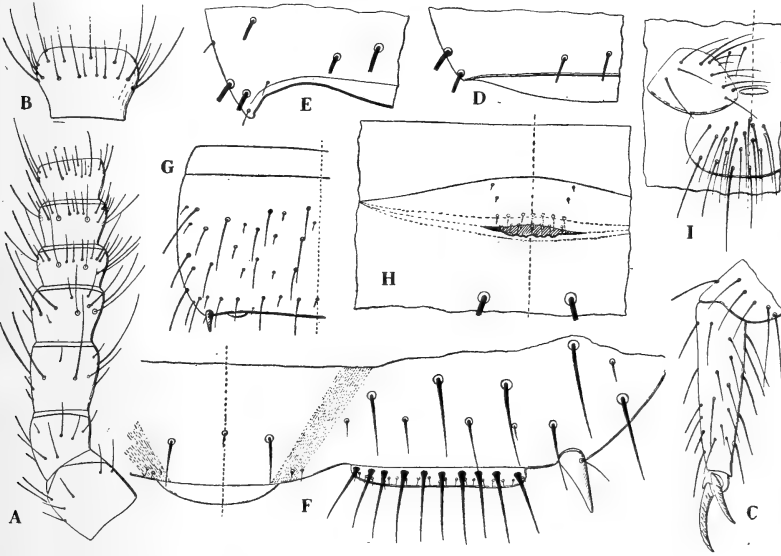


FIG. 14.—*Japyx barnardi* : A, antennae dexterarum pars proximalis prona ; B, ejusdem articulus decimus quintus ; C, pes parvis tertii a tibiae apice ; D, urotergiti sexti pars lateralis postica ; E, urotergiti septimi pars lateralis postica ; F, urosterni primi dimidia pars postica ; G, urosterni quarti dimidia pars ; H, maris urosterni tertii pars mediana antica ; I, maris regionis genitalis dimidia pars.

lateralibus brevioribus, scuto setis longis et sat longis 6+6 et nonnulla brevioribus instructis.

Pedes bene setosi, tarso quam praetarsus paulum magis quam duplo longiore infra setis 5+5 robustioribus, praetarsi unguibus attenuatis ungue postico quam anticus aliquantum longiore, unguicula mediana sat bene evoluta.

Abdomen : tergum primum praescuto eidem metanoti simili, scuto setis duabus submedianis subanticis et 2+2 submedianis et sublateralibus subposticis, tergita 3-7 setis sat longis et brevibus 11 (vel 12) +11 (vel 12), tergiti sexti angulus posticus late rotundatus, septimi in processum brevioris subtriangularem productus ; tergum octavum septimum longitudine subaequans et quam idem

aliquantum angustius lateribus postice rotundatis; segmentum nonum brevius.

Urosternum primum organis subcoxalibus sat latis inter sese parum minus quam unius latitudo remotis, setis glandularibus brevioribus

10 uniseriatis et setis subtilioribus brevissimis posticis 20 c. instructis, superficie pone organum subcoxale setis paucis ut cetera urosterna instructa, urosterni parte postica mediana parum arcuatim producta, poris indistinctis (an semper?) et utrimque setis duabus minimis aucta, urosterni superficie cetera setis sat longis transverse 4-seriatis et nonnullis brevissimis instructa.

Stili seta proximali externa brevi, vesiculæ multo bene distinctæ, parvæ.

Segmentum decimum supra inspectum parum latius quam longius carinis nullis, setis $8+1+8$ sat longis et nonnullis brevibus et brevioribus instructum, acropygio brevior.

Forceps quam segmenti decimi latitudo parum longior, brachiis asymmetricis dente peculiari destitutis, brachio laevo sinu præmediano sat profundo affectu, sinus angulo basali tuberculis conicis sat magnis

$\frac{3}{1}$, quorum duo supera basi connata,

sinus margine cetero tuberculis vix conspicuis 5 superis et 7 inferis, margine post sinum integrum, brachio dextero margine proximali sub-

recto integro, margine distali etiam integro, margine intermedio denticulis 6, quorum primus parvus acutus, ceteri gradatim minores.

Mas.—Urosternum tertium fovea transversali antica transversa setis c. 14 instructa.

Appendices genitales breviores, subconicæ, setis nonnullis brevibus instructæ.

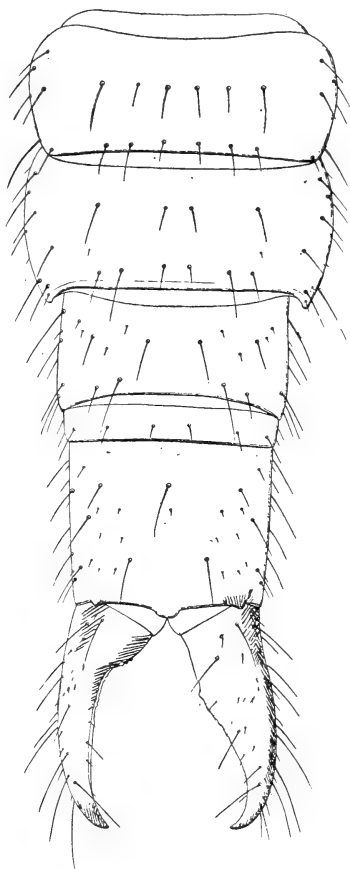


FIG. 15.—*Japyx barnardi*: abdominalis pars postica a segmento sexto.

Long. corporis 6 mm., lat. urotergiti septimi .78 mm., long. antennarum 1.35 mm., forcipis .6 mm.

Habitat.—Exempla duo legi in humo infossa ad Stellenbosch.

Observatio.—Species haec, quam clar. Dr. K. H. Barnard dico, forcipis forma inter omnes descriptas distincta est.

Japyx barnardi sp. n. var. *relata* nov.

Fig. 16.

Mas.—Urosteri primum organissubcoxalibus latis intersese parum minus quam unius latitudo remotis, setis glandularibus brevioribus 20 uniseriatis et setis subtilioribus brevissimis posticis c. 18.

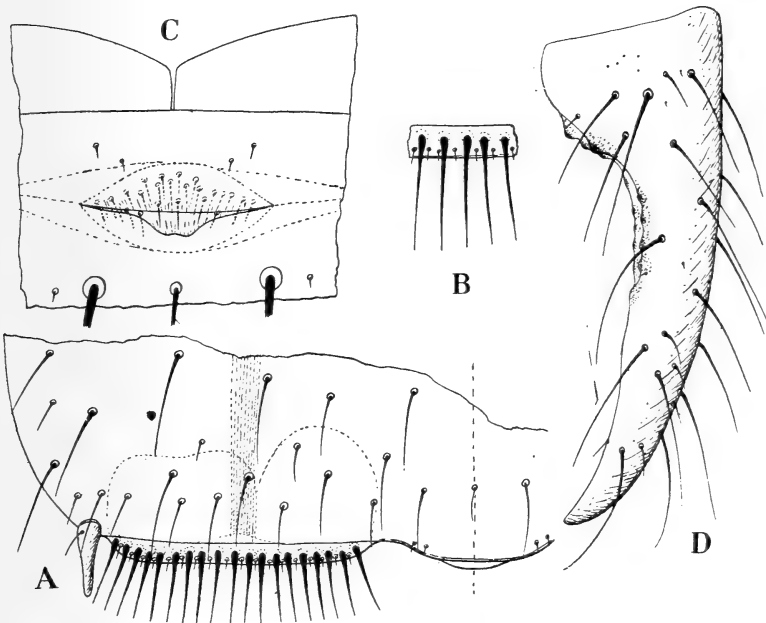


FIG. 16.—*Japyx barnardi* var. *relata*: A, urosterniti primi dimidia pars postica; B, ejusdem organi subcoxalis particula magis ampliata; C, maris urosteri tertii pars mediana antica; D, forcipis brachium laevum supinum.

Urosternum tertium parte mediana antica fovea glandulari transverse subelliptica setis brevioribus c. 22 instructa.

Forcipes brachii dexteri margine proximali vix trisinuato.

Characteres ceteri ut in forma typica.

Long. corporis 6 mm.

Habitat.—Exemplum descriptum in Museo Capense asservatum ad Newlands (Cape Peninsula) clar. Dr. W. F. Purcell legit.

Japyx fulleri sp. n.

Figs. 17, 18.

Mas.—Corpus albicans abdomine a segmento septimo ochroleuco, forcipe maxima pro parte badio.

Caput supra setis c. 10+10 sat longis et paucioribus brevissimis instructum; antennae 26-articulatae, articulis setis sat longis brevibus ut fig. 17, A, B demonstrant, trichobothriis superis internis

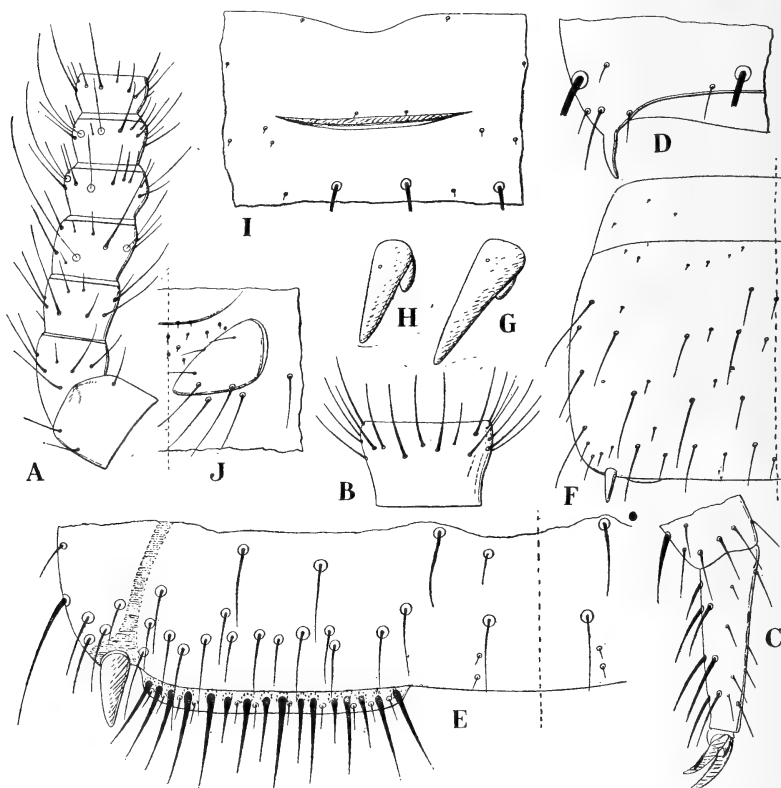


FIG. 17.—*Japyx fulleri*: A, antennae dexteræ pars proximalis prona; B, ejusdem articulus decimus quartus; C, pes paris tertii a tibiae apice; D, urotergiti septimi pars lateralis postica; E, urosterni primi dimidia pars postica; F, urosterni quarti dimidia pars; G, stilus urosterni septimi; H, stilus urosterni primi; I, maris urosterni tertii pars mediana antica; J, maris regionis genitalis dimidia pars.

longis; maxillae primi paris laminis pectinatis 5, palpus labialis brevissimus.

Thorax: pronotum setis sat longis et brevibus 5+5, meso-et metanotum praescuto setis duabus submedianis brevibus, scuto setis sat longis et brevibus 5+5, brevioribus 2+2 instructo.

Pedes tarso quam praetarsus magis quam duplo longiore infra setis robustioribus 4+3 instructo, praetarsi unque postico quam anticus parum longiore, unguicula mediana sat bene evoluta.

Abdomen: tergum primum praescuto eidem metanoti simili, scuto setis sat longis duabus submedianis subposticis, terga 3-7 setis sat longis 5+5 et paucis brevissimis, tergum sexti angulo postico rotundato, septimi in processum sat longum angustiore acutum producto; tergum octavum septimum longitudine subaequans et quam idem parum angustius lateribus postice haud productis, tergum nonum brevius.

Urosternum primum organis subcoxalibus inter sese unius latitudine remotis, setis glandularibus brevioribus et brevissimis 16 uniseriatis et setis brevissimis subtilioribus posticis c. 11 instructis, superficie pone organum

subcoxale serie transversali setarum breviorum, urosterni parte mediana postica poris vel disculis haud distinctis (an semper?) et setis minimis submedianis 2+2 instructa, superficie cetera ut eadem urosternorum ceterorum (praeter praesternum semper) setis paucis sat longis transverse 4-seriatis et setis aliis brevissimis instructa.

Urosternum tertium parte mediana antica fovea transversali lata angustissima, setis destituta, instructum.

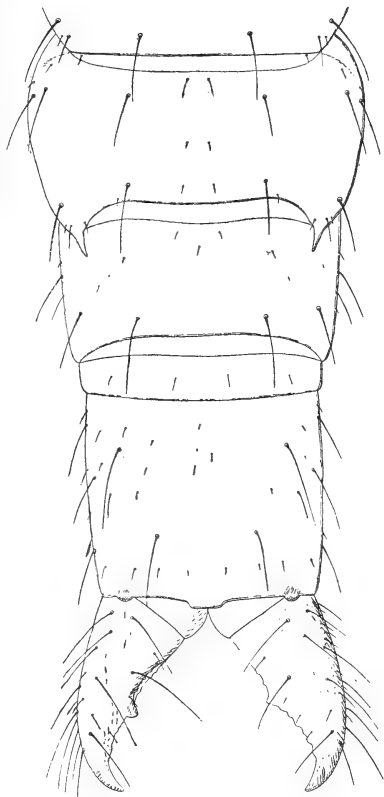


FIG. 18.—*Japyx fulleri*: abdominis pars postica a segmenti sexti parte postica prona.

Stili seta laterali nulla (an semper?), processu proximali supero brevissimo; vesiculae bene distinctae.

Appendices genitales conicae, setis paucis brevibus instructae.

Segmentum decimum supra inspectum parum ad basim latius quam longius carinis indistinctis, setis longis 5+5 et aliis modice numerosis brevissimis, acropygio brevissimo latiusculo.

Forceps quam segmenti decimi latitudo parum brevior, brachiis asymmetricis robustis, brachio laevo dente submediano sat magno, margine praedentali parum sinuato tuberculis $\frac{4}{3}$, margine postdentali

parum profunde crenulato, brachio dextero dente praemediano sat magno, margine praedentali tuberculis duobus uniseriatis, margine postdentali sat profunde crenulato.

Long. corporis 4 mm., lat. urotergiti septimi .45 mm., long. antennarum 1.1 mm., forcipis .3 mm.

Habitat.—Exemplum typicum ad Pretoria (Transvaal) in humo infossum legi.

Observatio.—Species haec, quae in memoriam clar. amici mei Claude Fuller dicata est, urosterni primi fabrica ad *J. barnardi* proxima est, sed urotergiti septimi et forcipis forma distinctissima est.

Parajapyx afer Silv.

Parajapyx grassianus Silv. var. *afer* Silv. Arkiv f. Zoologi, Bd. 8, No. 1, p. 7, fig. v.

This species was collected in Natal (Durban and Stamford Hill) by Dr. Trägårdh.

Parajapyx afer var. *transvaalica* nov.

Figs. 19, 20.

Corpus albicans abdominis segmento decimo et forcipe ochraceis.

Caput supra setis 19+19 brevibus vel sat brevibus instructum, antennis 18 (dextera)—19 (laeva) articulatis, setis vide fig. 19, B, C.

Thorax: pronotum setis 7+7, mesonotum praescuto setis duabus, metanotum praescuto setis 2+2, scuto setis 9+9.

Pedes breves tarso quam praetarsus c. $\frac{1}{3}$ longiore, praetarsi unguibus subaequalibus.

Abdominis tergum primum praescuto setis 2+2, terga 2–7 praescuto setis 1+1+1, scuto angulis posticis rotundatis setis 9+9, quarum 6 sat longae sunt.

Urosternum primum organis subcoxalibus latis setis saltem 40,

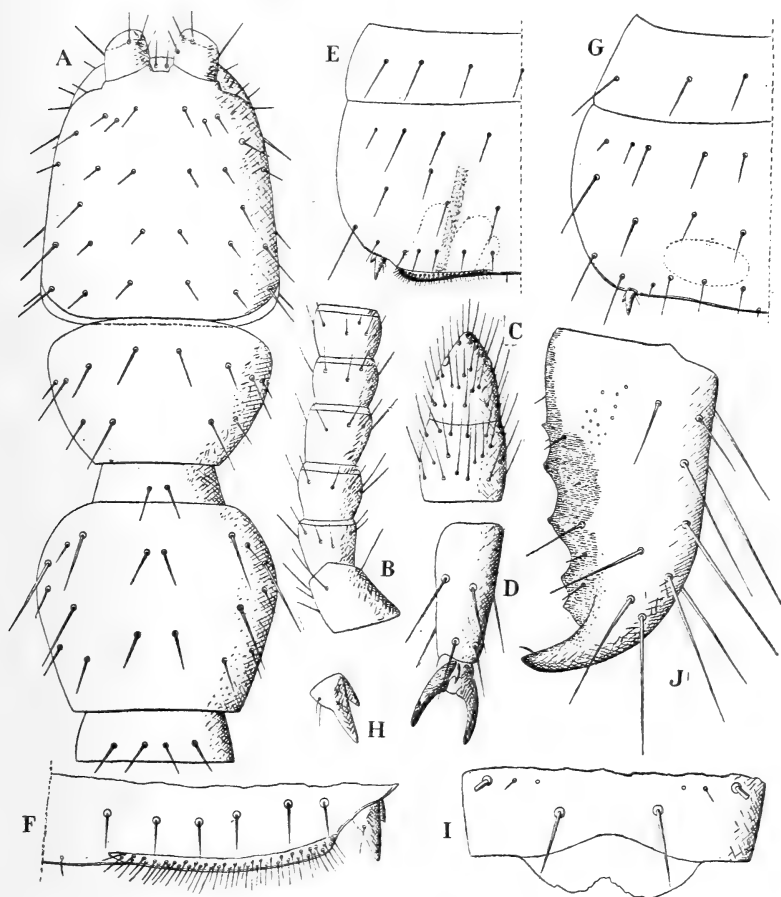


FIG. 19.—*Parajapyx afer* var. *transvaalica*: A, caput et thorax usque ad metanoti praescutum prona; B, antennae dexteræ pars proximalis; C, ejusdem pars apicalis; D, tarsus et praetarsus supra inspecti; E, urosterni primi dimidia pars; F, ejusdem dimidia pars postica magis ampliata; G, urosterni secundi dimidia pars; H, stilus magis ampliatus; I, segmenti decimi pars postica ventralis; J, forcipis brachium dexterum prona.

biseriatis instructis, superficie pone organum subcoxale serie setarum 6 aucta, superficie cetera setis paucioribus instructa; urosterna 2-3 vesiculis permagnis transverse ovalibus; stili processu spiniformi externo brevior aucti et setis duabus brevissimis internis.

Abdominis segmentum octavum subaeque longum atque latum; segmentum nonum fere duplo latius quam longius; segmentum decimum supra mensum paullum longius quam latius, setis 6+6 sat

longis et setis 4+4 brevioribus instructa, acropygio sat magno

subtriangulari, margine postico infero sinu mediano sat profundo et per margines irregulariter serrulato, parte submediana margine postico irregulariter lobulato.

Forceps quam segmenti decimi latitudo aliquantum brevior brachiis subaequalibus margine dente basali minimo, pone dentem basalem paullum sinuato, dente secundo perparvo, dente tertio sat magno, dentibus quarto et quinto parvis, parte postdentali brevior crassiuscula, angustata.

Long. corp. 3.2 mm. ; lat. urotergiti septimi .36 mm., long. antennarum .78 mm., forcipis .2 mm.

Patria.—Africa australis : Pretoria (Transvaal), exemplum typicum in humo infossum legi.

Observatio.—Species haec a forma typica ex Durban (quae antennis 20-articulatis instructa est) antennarum articulorum numero et organis subcoxalibus latioribus setis magis numerosis instructis saltem sat distincta est.

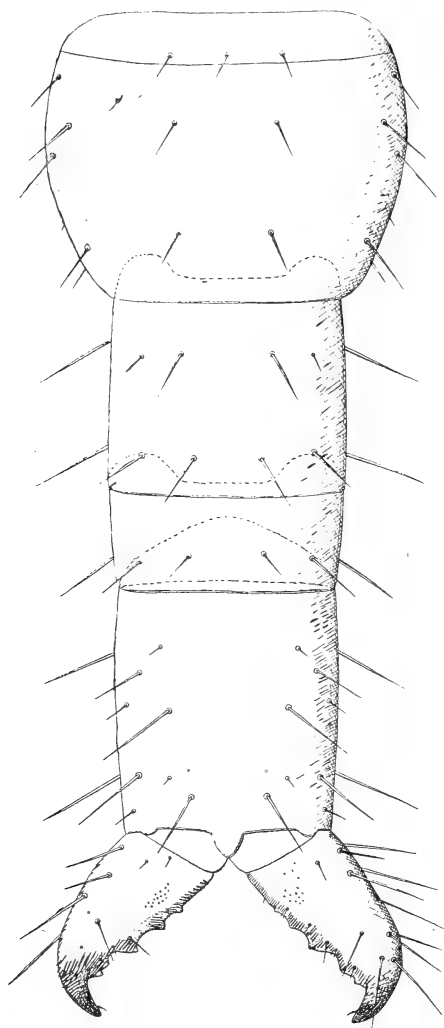


FIG. 20.—*Parajapyx afer* var. *transvaalica* : abdominis pars postica a segmento sexto.

Japyx hutchinsoni sp. n.

Figs. 21–24.

Femina.—Corpus colore consueto ; caput setis parum longis c. 12 +12 et setis brevibus, brevioribus et brevissimis sparsis instructum ;

antennae 40-articulatae, articulis setis longis, brevibus et brevioribus ut fig. 21 (1-2) demonstrant, trichobothriis superis internis brevibus ex fovea perparva orientibus; maxillae primi paris lobus internus laminis pectinatis 5, palpus labialis 0.32 mm. longus.

Thorax: pronotum setis sat longis 5+5 et nonnullis brevibus et brevioribus instructum; mesonotum praescuto setis brevibus 4+4

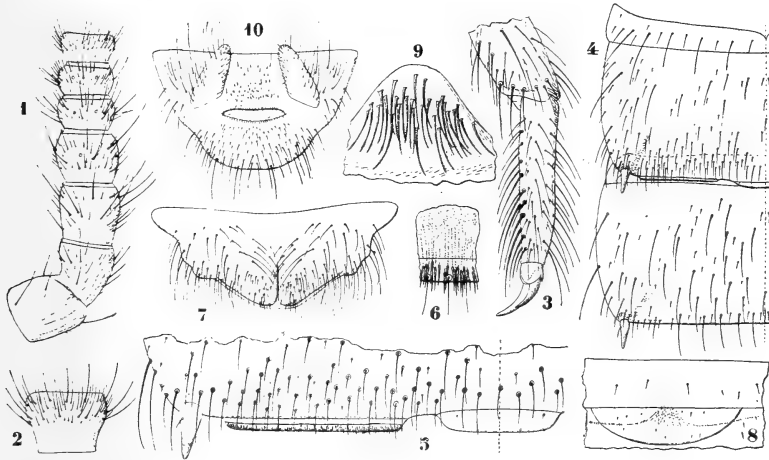


FIG. 21.—*Japyx hutchinsoni*: 1, antennae laevae 1-7 supra inspecti; 2, ejusdem antennae articulus vigesimus; 3, pes parisi tertii a tibiae parte distali; 4, urosterni primi et secundi dimidia pars; 5, urosterni primi dimidia pars postica; 6, ejusdem organi subcoxalis particula magis ampliata; 7, feminae valvae genitales antice inspectae; 8, maris urosterni tertii pars mediana antica; 9, ejusdem urosterni processus detectus et magis ampliatus; 10, maris apertura et appendices genitales.

et allis brevissimis numerosis, scuto setis longis et sat longis 8+8 et nonnullis brevibus et brevioribus, metanotum scuto setis longis et sat longis 5+5.

Pedes tarso quam praetarsus fere triplo longiore infra setis robustioribus 8+7, praetarsi ungue postico quam anticus aliquantum longiore unguicula brevior.

Abdomen: tergum primum praescuto setis duabus submedianis brevibus, scuto setis duabus submedianis anticis brevibus, duabus sat longis submedianis supposticis et setis paucis (6-8) brevioribus, tergita 3-7 setis 5+5 sat longis, paucis brevibus et brevioribus et aliis aliquantum numerosis minimis; tergiti sexti angulus posticus subrectus, septimi in angulum sat longum acutum productus; tergum octavum quam septimum parum brevius et angustius lateribus rotundatis; tergum nonum brevius.

Urosternum primum organis subcoxalibus inter sese unius latitudine remotis, setis glandularibus brevissimis 2-3 inordinatim seriatis et setis uniseriatis posticis inter sese aliquantum remotis et quam glandulares parum longioribus instructis, superficie pone organum

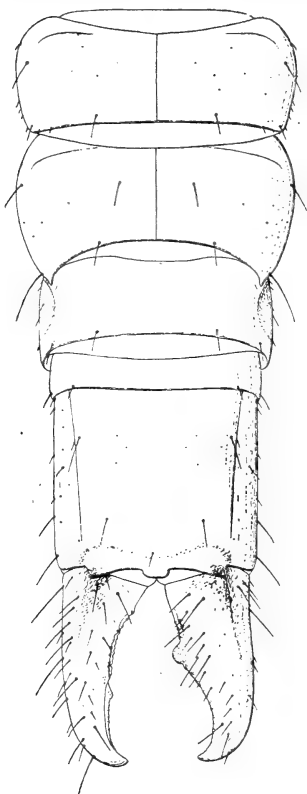


FIG. 22.—*Japyx hutchinsoni*: corporis pars postica a segmento sexto prona.

subcoxale setis brevibus sat numerosis 2-3 inordinatim transverse seriatis et setis nonnullis brevissimis, urosterni parte mediana setis brevissimis 2+2 instructa, urosterni superficie cetera setis longis, brevibus sat numerosis 4-5 transverse seriatis et setis brevioribus et brevissimis nonnullis instructa.

Urosterna cetera setis longis, brevibus, brevioribus primo similia, vesiculis perparvis, stilis robustis.

Segmentum decimum spura inspectum parum latius quam longius, carinis sub-lateralibus subintegris setis sat longis 5+5 et nonnullis brevibus et brevioribus, acropygio sat magno postice late rotundato.

Forceps robusta segmenti decimi latitudinem subaequans, brachiis asymmetricis, brachio laevo dente postmediano sat magno margine praedentali parum sinuato tuberculis $\frac{8}{12}$, quorum primus superus, tria infera quam cetera majora sunt, margine postdentali tuberculis $\frac{0}{12}$, perparvis gradatim evanescentibus, brachio dextero dente proximali

magno, margine praedentali laterculis $\frac{2}{3}$, margine postdentali infero fere usque ad apicem tuberculato (vel crenulato).

Long. corporis ad 20 mm., lat. urotergiti septimi 3, long. antennarum 6, forcipis 2.

Larva prima (fig. 23): long. corporis 6 mm., lat. urotergiti septimi 0.65, long. antennarum 1.85, forcipis 0.55.

Corpus tantum setis brevissimis parum numerosis instructum.

Antennae 40-articulatae, setis tantum nonnullis brevissimis ab articulo quarto uniseriatis instructis.

Abdominis tergum septimum angulis rotundato, urosternum primum organo subcoxali indistincto, forceps brachiis subaequalibus subconicis, setis brevissimis parum numerosis instructis at brachii

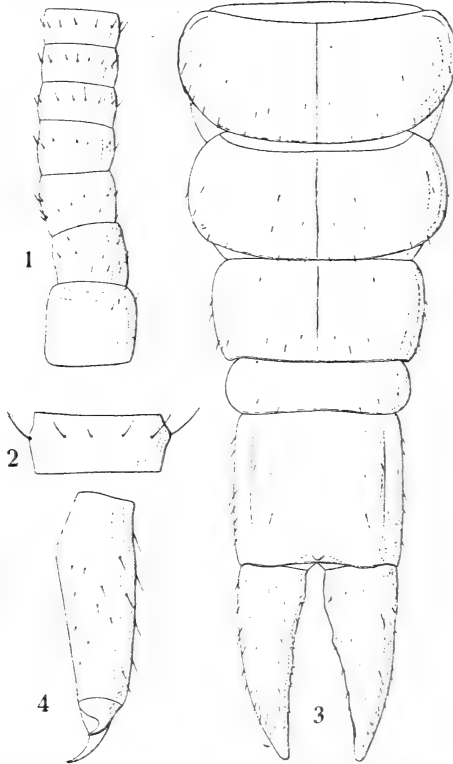


FIG. 23.—*Japyx hutchinsoni*, prima larva : 1, antennae dexteræ pars proximalis ; 2, ejusdem articulus vigesimus ; 3, corporis pars postica a segmento sexto prona ; 4, pes parvis tertii tarsus et praetarsus.

laevi margine interno denticulo spiniformi submediano minimo et brachii dexteri denticulo minimo fere opposito et spinulis minimis aliis 4-5 instructo.

Pedes praetarsi ungue postico quam anticus fere duplo longiore, unguicula mediana nulla.

Mas.—Urosternum tertium fovea mediana pone praesternum et ex foveae parte postica processu subtriangulari latiusculo apice rotundato superficie setis plumatis robustis numerosi aucta instructum.

Appendices genitales longiusculae setis vide fig. 21 (10).

Habitat.—Devils Bosch Swellendam (G. F. Hutchinson, 12, xii, 26 legit).

Observatio.—Species haec, clar. G. F. Hutchinson dicata, a *J. peringueyi* antennarum articulorum numero, urotergiti octavi depressione laterali et maris processu tertio antico sternali distinguenda est.

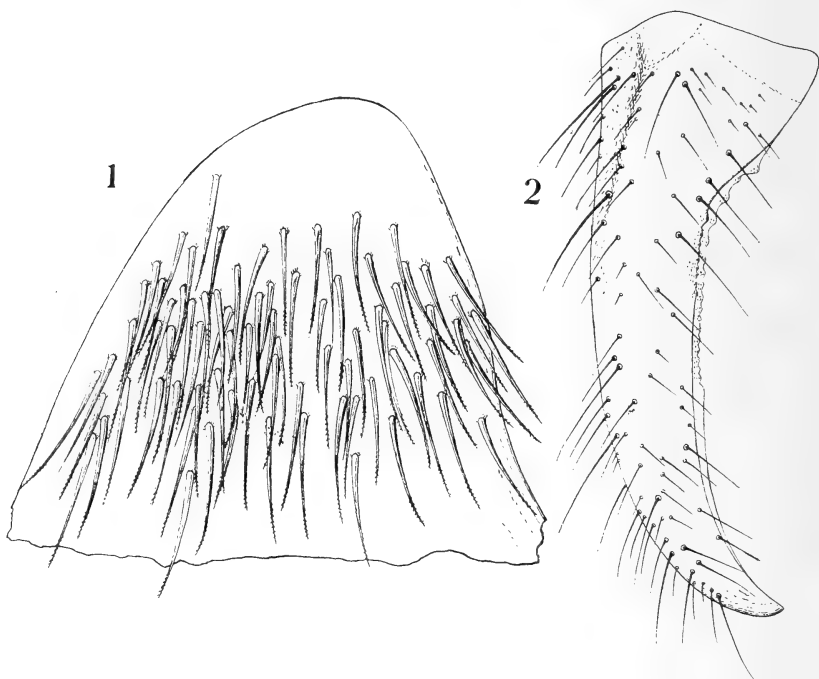


FIG. 24.—*Japyx hutchinsoni*, varietas: 1, urosterni tertii processus anticus detectus; 2, forcipis brachium laevum.

Varietas.—Mares duos ex eodem loco vidi, qui magnitudine (corporis long. ad 29 mm.) et forcipis brachii laevi partis distalis margine integro, nec non urosterni tertii processu majore distincti sunt, sed feminis absentibus ut mares heteromorphi ejusdem speciei ad tempora considerandi sunt.

3. *A South African Species of Protura*.—By H. WOMERSLEY,
A.L.S., F.E.S.

(With 2 Text-figures.)

THIS order of insects, first discovered by Professor Silvestri in Italy, has so far only been recorded from America, India, Java, and most European countries.

During seven weeks spent in Cape Town on entomological research on behalf of the Australian Commonwealth Council for Scientific and Industrial Research, intensive search was made for African members of the order as opportunity offered.

It was, however, not until a few days before leaving that, in company with Dr. Lawrence of the Cape Town Museum, I was successful in finding a few specimens in the Orangezicht district of the town itself.

The situation was a piece of vacant land on which were a number of large stones lying in the clayey soil. This type of locality is similar to that in which I have found many species of Proturans in England.

From this locality two specimens were secured, although altogether four were observed. During the next day or two other specimens were seen in a similar location on the lower slopes of Devil's Peak. I was not successful in tubing these.

I have now been able to study the two specimens that were captured, and shall here describe them as a new species of the genus *Acerentulus* of Berlese. Further search will no doubt bring to light other South African members of this interesting and primitive order.

The two specimens will be deposited in the South African Museum at Cape Town.

[ORDER, etc.

ORDER PROTURA Silv.

FAMILY ACERENTOMIDAE Berl.

Subfam. ACERENTOMINAE Wom.

Genus *Acerentulus* Berl.*Acerentulus capensis* sp. nov.

(Text-figs. 1, 2.)

Length (extended in acetic acid) $1350\ \mu$. Head $105\ \mu$ long by $76\ \mu$ wide, ratio of length to width (Ll)=1.4. Labrum not produced. Pseudocelli large, round, $10\ \mu$ diameter. Fronto-medial cephalic setae $14\ \mu$, basal $10\text{--}12\ \mu$.

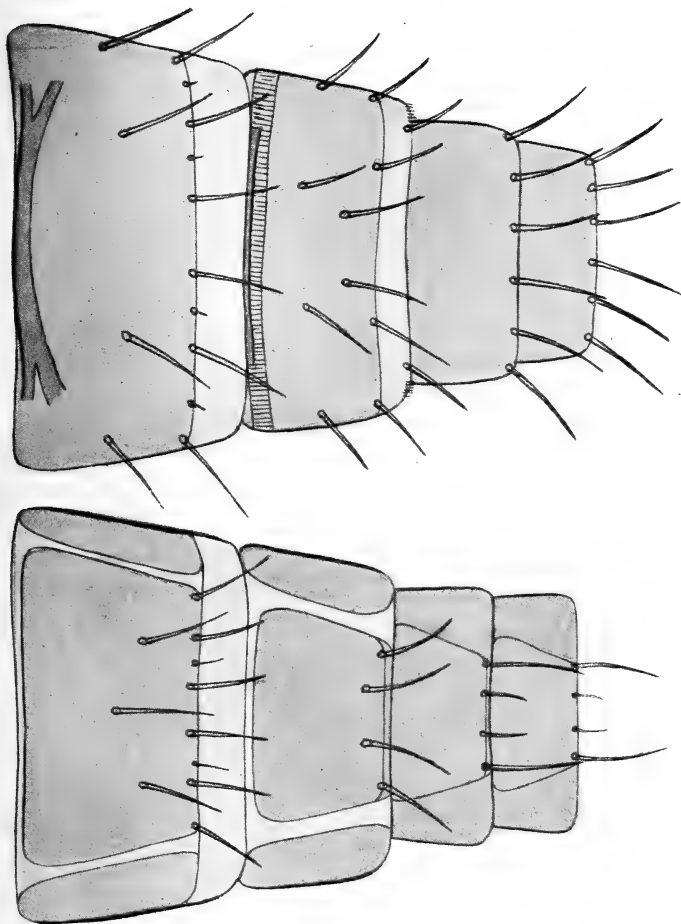
Head generally fairly well chitinised.

Thorax well chitinised. Anterior legs $225\ \mu$, tarsus $72\ \mu$, claw evenly curved $18\ \mu$, tarsal ratio (TR)=4.0, tarsal setae at tip $30\ \mu$, middle legs $150\ \mu$, posterior legs $165\ \mu$.

Abdomen well chitinised, tergal apodemes well developed and evenly curved. Abdominal appendages on segments I-III typical of the genus, anterior pair $40\ \mu$ long by $20\ \mu$ wide, with parallel sides. Pectines on segment VIII normal.

Chaetotaxy. This is shown for segments VII-X in the figures. On III-VI it is similar to that on VII. On the other segments it is not sufficiently clear to describe. On tergites IX-X the setae are the usual six, of equal length and twice as long as the chitinised portion. On the corresponding sternites they are four, the outer ones being twice as long as the chitinised part, but the medial setae only one-third the length of the outer setae.

In members of this genus few characters of specific value can be found. Those used in the above description, namely, the ratios Ll and TR and the arrangements of setae on the tergites and sternites, as well as their relative lengths, are of most value and can be considered as reliable.



Accerentulus capensis sp. nov.

FIG. 1.—Sternites VII-X.

FIG. 2.—Tergites VII-X.

4. *A New Solifuge and Scorpion from South-West Africa.*

By JOHN HEWITT.

(With 3 Text-figures.)

Solpuga striata Krpln.

(Text-fig. 1.)

Beit. z. Kennt. Land- u. Süßwasserfauna Deutsch-Südwestafrikas,
Skorpiones u. Solifugae, p. 124, fig. 1, 1914.

THIS species, founded on a very immature specimen from farm "Voigtsland," about 38 kms. east of Windhuk, is apparently very closely allied to *celeripes* Hirst.* We have a series of adult male examples from Okahandja—which is only about 20 miles distant from "Voigtsland"—and from farm "Quickborn," near Okahandja, presented by Mr. R. D. Bradfield, which presumably belong to *striata*, assuming that only one species of this group occurs in Damaraland. They may be the same also as the species recorded from Damaraland recently † under the name of *sericea* Poc., a species founded on Salisbury specimens: for they have relationships with that species.



FIG. 1.—*Solpuga striata* Krpln. Upper mandible and flagellum of adult male.

The Okahandja males have the following characters:—

Upper surface of chelicera with some spiniform bristles and a few long bristly setae; base of flagellum high with well-rounded outline,

* Manchester Memoirs, lvi, No. 2, p. 10, fig. 2, 1911.

† Dr. R. Lawrence in Ann. S. Afr. Mus., vol. xxv, p. 261, 1928.

margin of hinder half brown, otherwise the colour is pale; free portion of flagellum flattened antero-posteriorly; viewed from above it is broadest at the base, thence tapering quite regularly to the apex which is finely pointed; in side view the ascending portion is lightly curved, becoming suddenly curved downwards and narrowing rather abruptly near the apex. No tooth on the superior inner margin of the fang near its base. Stridulatory area with seven ridges. Lower jaw with short fang, but the apex of the first tooth is slightly nearer to the apex of the basal tooth than to the tip of the fang. Lower jaw with feathered bristles on the inner surface.

The flagellum of these specimens is shorter than that of *celeripes*, and the apical end is not so sharply differentiated as in that species; but quite probably they will prove to be connected by intermediates. Total length, including chelicerae, 18 mm.

Chelypus shortridgei sp. nov.

(Text-fig. 2.)

Type.—A single adult male specimen collected by Captain G. C. Shortridge at a locality about 10 miles north of Karakuwisa, in the bed of the Omuramba-Omatako River, about 140 miles N.N.E. of Grootfontein township, South-West African Protectorate, on May 4th 1929. It is the first record of the genus from South-West Africa.

The species is closely related to *C. macronyx* Hewitt (Records Albany Museum, iii, p. 214, 1919), taken in some part of North-West Rhodesia. The surfaces of the chelicerae and head-plate are apparently more spinose or granulate than in *shortridgei*, and there are differences in the form of the flagellum apically. The presence of a distinct double row of teeth in the lower jaw may also prove peculiar to *shortridgei*. In both species, however, only a single specimen is known.

Lower Jaw.—The terminal fang is strongly upturned. No large teeth whatever, but two dental rows are clearly represented; the inner row, consisting only of several indistinct denticles, is quite short, extending from the distal end of the patch of stiff setae to the base of the fang; outer row long, including two small teeth basally and a few minute denticles mostly distal thereto; between the two small teeth is a single denticle situated nearer to the basal tooth.

Upper Jaw.—Upper surface with rather stiffish hairs and a few minute and slender spinules towards the base of the fang, especially on the inner side. Fang well curved downwards. A small dense

patch of about 17 or 18 short spines on the mesial surface just posterior to the large black tubercle situate dorsally near the base of the fang on its inner side. Posterior to this tubercle and more mesially situate are two other moderate sized black tubercles. There is only one functional row of teeth, the outer row; it includes 5 widely spaced teeth, the middle one the largest; the inner row is represented by a single minute denticle basally and a tubercle immediately adjacent to the basal enlargement of the flagellum. Mesial surface with long silky hairs except over the "stridulatory area"; also, in the region where feather-bristles occur in *Solpuga* the hairs are relatively stiff.

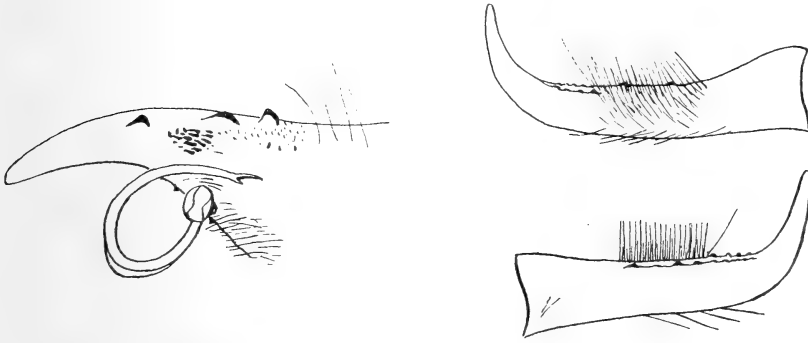


FIG. 2.—*Chelypus shortridgei* sp. nov. Upper jaw and flagellum, inner side.
Lower jaw: above, inner side; below, outer side.

Stridulatory area with a reticulation of fine grooves but no parallel ones, and none arranged longitudinally.

Flagellum is freely rotatable; has a large cup-like base; has a flattened membranous extension at the basal curve; is bifid at the apex, both portions being finely pointed, the inner one being tooth-like and much shorter than the other.

Head-plate bearing long hairs and with very minute dust-like granulation scarcely visible under a hand-lens. Two distinct ocular tubercles, the eye on the outer side of each.

Legs.—Claws of third leg both longer than the peduncle, of the one only slightly, of the other $1\frac{1}{3}$ times longer. (Claws of II lacking in specimen.) Patellæ II with a row of 6 spines on the outer side. Patella III with the extensive granulated area bordered on one side by a row of 9 short stout spines, basal ones strongest, and on the other side by 3 longer spatulate spines near the distal end. A row of weaker spines probably occurs along tibia and tarsus III, but the spines are missing in the specimen except one on the tarsus.

Colour.—Very pale throughout, except anterior portion of head-plate which is infuscated, spines and spinous areas which are reddish ; fang of upper jaw up to the two mesial dorsal tubercles and the whole of the lower jaw except the hairy parts dark chestnut.

Total length, including chelicera, 21 mm.

The occurrence of two rows of teeth in the lower jaw is noteworthy. In *Solpuga* an inner row is more or less represented, but only in rudimentary form towards the base of the jaw. In that genus the inner tooth row may perhaps be represented distally by a sharp but not prominent ridge on the inner surface of the terminal fang.

In the specimen now described, the inner row of teeth is not in any way represented towards the base of the jaw, being only found distal to the patch of bristles ; none of which are feathered, but is not continued into the terminal fang as a ridge.

In the genus *Ceroma* the inner tooth row of the lower jaw is also represented by a prominent ridge more nearly in the position occupied by that of *Chelypus* ; it is continued, however, into the terminal fang, but only very feebly so.

I take this opportunity of recording the type locality of *Chelypus barberi* Purcell as Zandkuil. The late Mr. H. Barber told me that it was taken in June, "running round and round and winding about on the ground." On the other hand, Captain Shortridge remarks that the specimen he collected was walking as slowly as a tortoise over loose sand ; it was pugnacious like an ordinary *Solpuga* and the hooked legs appeared to be grasping organs.

Opisthophthalmus opinatus (Simon).

Ann. Soc. ent. France, p. 382, 1887.

This species, described under the name of *Mossamedes opinatus*, and supposed to have been collected in Mossamedes, is still imperfectly known. Simon described the hand as "supra laevis obsoletissime tuberculo-striata," and the tergites as "subtilissime punctata." According to Kraepelin, all the tergites and sternites are "fein nadelstichig," whilst the hand has a "wulstigen kiel," and its inner surface "nadelstichigen wulsten" ; also the smooth interocular area is "nadelstichig." Whether Kraepelin's two accounts (*Das Tierreich*, Scorpiones, p. 130 ; and *Jahrb. der Hamburg. Wiss. Anst.*, xi, 1, p. 81, 1894) are based on precisely the same form as that described by Simon is a point not determinable from their descriptions ; quite possibly they are not so, for the pectinal teeth of the female are

16-18 according to Simon, 19-21 according to Kraepelin. The form described below as

Opisthophthalmus opinatus bradfieldi subsp. nov.

was collected by Mr. R. D. Bradfield in limestone crevices at Krantzberg in the Namib desert, near Usakos, South-West African Protectorate. The types are one adult female and one subadult male;

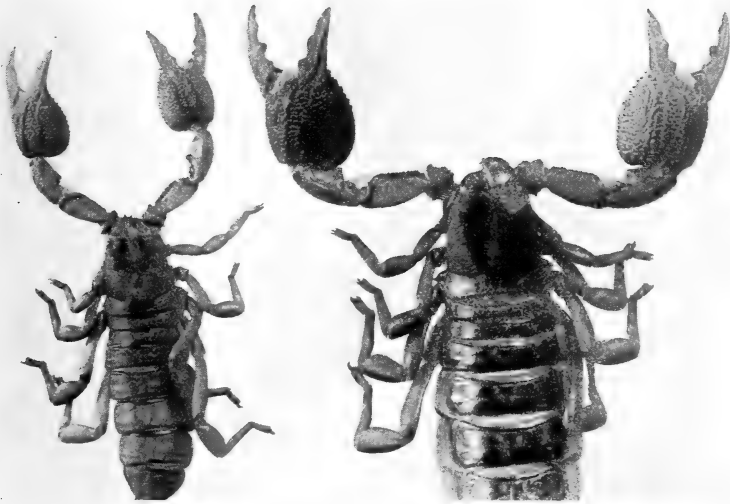


FIG. 3.—*Opisthophthalmus opinatus bradfieldi* subsp. nov. Type male (left) and female (right) specimens from Krantzberg.

these and two other examples were kindly presented to the Albany Museum by Mr. Bradfield. The more important characters are: carapace with a smooth and polished interocular area which is free of punctations except on each side about four faint ones in the female, sides of carapace granular but not coarsely so, anterior lobes with granular edge which is lightly curved, median incision deep and quite short, median groove deep in front of the median eyes and its margins granular, becoming faint and shallow near the median incision where it bifurcates, although in the male the bifurcation is imperfect; tergites I-VI of female all with scattered punctations which are superficial and not conspicuous, of male without punctations or almost so; all the sternites with punctations, but quite few in number and almost entirely confined to the sides; caudal segments with granular superior keels, II-IV with subspiniiform end-

teeth, I and II without inferomedian keels (*i.e.* not defined on the mesial side), III with inferomedian keels which have several punctations but no granules, IV with granulations and punctations; hand quite stout in female, less so in male—but apparently not so prominently lobed as in the type—finger-keel much broken up into isolated granules, only in the distal half more or less continuous, the outer portion of the upper surface with rather small well-separated granules, and down the middle an accessory keel represented by a rather irregular row of granules, the inner portion of the upper surface well curved, in female entirely covered with isolated but closely packed flattish tubercles which are rounded or oval or irregular, in male with large granules less closely packed and not much flattened, accessory keels being lacking in female, feebly indicated in male; no punctations traceable on the upper surfaces of the hand; lower surface of hand well granulated over the inner portion; antero-dorsal keel of brachium fairly smooth but weakly crenulate, postero-dorsal keel granular and very indefinite; antero-dorsal crest of humerus granular and very well defined; fourth tarsus with 2 spines on its anterior edge below, the superior lobe much shorter than the lateral lobes; protarsi I and II with 3 longer spines on the outer side superiorly, and below with 5 short spines in the distal half of the segment; genital operculum much longer relatively in the female; pectinal teeth of male 24–25, of female 17–19, the scape in the female being free of teeth over a distance equal to about a third of its length; another small male has 23 pectinal teeth. Chelicerae with well-developed stridulatory lamellae.

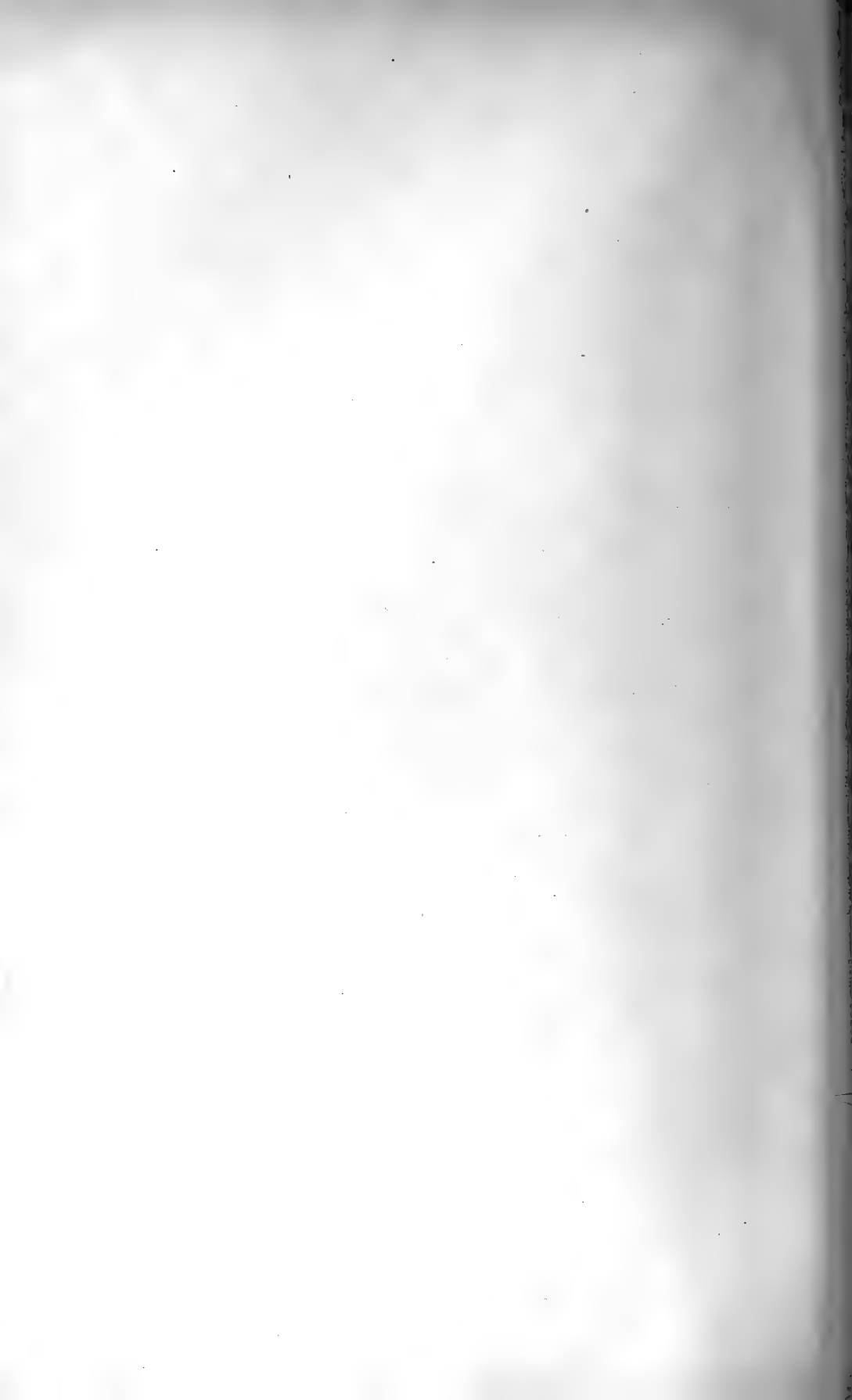
Colour.—Carapace, tergites and tail brown, not very dark; legs and vesicle yellow; palps a darker brown in the adult female, but not in male and young, the keels not conspicuously darker except distally in the female.

Measurements.—Length of carapace, M. 13, F. 17; breadth thereof, M. 12.2, F. 17; distance from hind margin to median eyes, M. 5.5, F. 6.6; length of tail, M. 41, F. 61; length of caudal segment V, M. 9.5, F. 15.2; breadth thereof, M. 3.5, F. 4.5; breadth of hand, M. 9.5, F. 14.5; length of hand—back, M. 8, F. 11; length of movable finger, M. 11.5, F. 17.

The male, though so much smaller than the female, is apparently sexually mature, judging from the opercular characters. It may be noted that the proportions of the hand are not very different in the two sexes, less so than is usual between fully adult specimens in this genus. There is a difference in the nature of the surfaces of the

tergites which are smooth and polished in the female, but quite matt in the male. An important character of the species is the depth and shortness of the median incision of the carapace and the abbreviated bifurcation of the median groove; in this respect, the species agrees well with a *Pandinus* and differs from any typical *Opisthophthalmus*. In the stridulatory characters it agrees entirely with the latter and likewise in the pedipalp generally. The chief distinctive characters of *bradfieldi* seem to be those furnished by the surfaces of the hand.

According to Mr. Bradfield, this scorpion has a very restricted range at Krantzberg, occurring only on about one acre of limestone rock in which it occupies crevices about 2 feet deep which seem to be partly made by the animal.



5. *A New Peripatopsid from the Table Mountain Caves.*

By R. F. LAWRENCE, B.A., Ph.D., Assistant in Charge of Arachnida.

(With 3 Text-figures.)

THE *Peripatus* forms in Africa are all found at the extreme south of the continent with the exception of one equatorial species; strangely enough, no representative has as yet been found in Madagascar. These southern forms were defined in 1899 by Purcell, working at the South African Museum, and he divided them into two groups, a predominantly Western and an Eastern one, the former consisting of six species, the latter of only one. The Eastern, a more primitive and smaller form, is represented by the one genus *Opisthopatus*, while the Western species are all included in the genus *Peripatopsis*. These groups are distinguished by embryological as well as structural divergences. In the Eastern type, *Opisthopatus*, the uterus of the female contains embryos at different stages of development and the young are born at different times during the year, while in the Western Cape forms, *Peripatopsis*, the uterine embryos are all more or less at the same stage of development and the young are born at intervals of a few days to a week during the same month, usually May.

The geographical distribution of the six species of *Peripatopsis* is as follows: *moseleyi*, the most eastern form, is found in Natal and the eastern parts of the Cape Province. The more central parts of the Cape Province are occupied by *sedgwicki* and *clavigera*, *sedgwicki* being known from Grahamstown, Humansdorp, and Knysna, while *clavigera* seems to be more localised, being found only at Knysna. Proceeding westwards, *balfouri* and *capensis* have roughly the same distribution in the south-west corner of the Cape; it is a fairly wide one and perhaps reaches as far eastward as Knysna. *P. leonina*, a small species with a larger number of legs than the other Cape species, has a peculiarly localised distribution, being found in the Cape Peninsula on Signal Hill and nowhere else; its distributional area thus nowhere overlaps those of the other species as those of *balfouri* and *capensis* overlap each other, these latter two species being found together in most localities of the Cape Peninsula, and also at Swellendam.

Recently two further species have been added—*intermedia* from Swellendam described by Hutchinson in 1928 (Ann. South African Museum, vol. xxv, pt. ii, p. 337), and that described in the present paper.

The Cape Peninsula, the extreme south-western corner of the African continent, thus possesses four species of *Peripatopsis*, a greater number than any other locality in Africa; it is also significant that the species with an extremely limited distribution all occur in the Cape Peninsula.

The caves in which these specimens were found occur near the top of Table Mountain in sandstone formation, and appear to have been formed either by pressure rifting apart the cleavage fissures or by the action of water. The cave of which fig. 1 represents a diagrammatic longitudinal section is remarkably deep and labyrinthine, a tortuous and narrow entrance leading down about 100 feet below the surface to the main gallery, which is fairly roomy with a sandy floor. The walls of this chamber are damp and slimy from the water which is constantly percolating through fissures in the rocks. There is in this lowest part of the cave absolute darkness, and the only vegetation seems to consist of a small greyish lichen



(From *The Mountain Club Annual*, No. 13, 1909-10.)

FIG. 1.—Elevation of Table Mountain Caves. Localities where specimens of *Peripatopsis* were found marked P.

doubtfully referred to *Lecanora*. As might be expected, the fauna of the cave is meagre, the animal most plentifully represented being *Speleiacris tabulae*, a peculiar form of Orthopteron with slender elongated antennae and legs, belonging to a group not found outside of South Africa; these are found in comparatively large numbers running about on the walls of the cave. Under stones were found a Collembolid and one or two Coleoptera; among the crustacea an Isopod and an Amphipod; the Arachnida were represented by two species of Opiliones, one false scorpion and two species of Araneae, a minute red Argiopid spider and a Dictynid spider (*Auximus longipes*); Myriopoda were represented by a single specimen belonging to the order Polydesmoidea. Of all these, only one species of Opilionid, *Speleosiro argasiformis*, was eyeless, but this belonged to a primitive suborder, the Cyphophthalmi, whose members are in nearly all cases blind; another member of this suborder has been recorded from caves in the Ukraine.

The specimens of *Peripatopsis* found, four in number, were taken under stones or climbing up the wet almost vertical walls of the cave, and were observed by the light of electric torches to be dead white in colour. Two specimens which were not immediately drowned died after twenty-four hours, although kept under conditions which would have ensured survival in the case of *P. capensis* or *P. balfouri*.

Peripatopsis alba n. sp.

(Text-figs. 2, 3.)

Colour.—Body dorsally and ventrally, appendages, dead white, claws dirty white tipped with brown, body above in the middle line with a thin opaque stripe extending from the anterior end of the head to a little before the posterior end of the body, where it becomes evanescent; this stripe corresponds exactly in position to the narrow median black stripe on the dorsal surface of *P. balfouri*.

Eyes absent.

Skin resembling that of *P. balfouri*, consisting of numerous conical papillae, which are themselves covered with much smaller granules; these conical papillae a little larger than but similar in shape to those of *P. balfouri*.

Segments of body with 8 or 9 larger annulations.

Legs 18 in number, all with distinct claws, the last (genital) pair of legs minute but with distinct claws; in the male the penultimate pair of legs very noticeably shorter than the preceding pair; middle

pad of legs more than twice but not three times as broad as the proximal pad; the foot much more elongate than in any other species of *Peripatopsis*; the legs themselves distinctly longer than in other species; compared with *balfouri* (fig. 2, *c*, *d*) the legs from where they join the body to the beginning of the foot are slenderly conical and

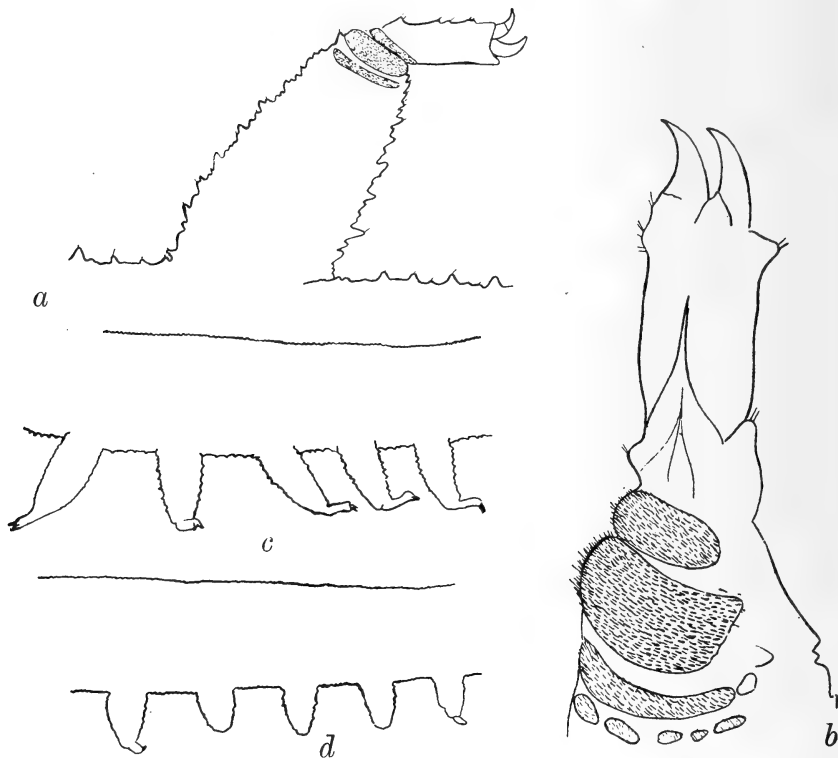


FIG. 2.—*Peripatopsis alba* ♂, *a*, ninth leg; *b*, sole and foot of same enlarged; *c*, legs 7-11 seen from the side; *d*, legs 8-12 of *P. balfouri* seen from the side.

taper a little distally, while in *balfouri* they are bluntly rounded. No trace of coxal organs in any of the legs.

Measurements.—Larger male specimen: length of body about 51 mm.; length of legs in the middle of body, 2.1 to 2.6 mm.; foot, .8 to .9 mm.

Types: 1 adult male, 1 subadult female.

This *Peripatopsis* most nearly resembles *P. balfouri*; it has the same number of legs and the structure of the integument is very similar. If it were not for the distinctly longer legs this species

would appear to be an aberrant form of *balfouri*, an eyeless and unpigmented mutant of the latter. The most arresting feature of this animal is perhaps the total lack of pigmentation; search under low and high powers of the microscope failed to reveal the slightest trace of it. This is the more striking in that Onychophora from all parts of the world are characteristically and strongly pigmented; the velvety blackish-green colour of *balfouri* is the most striking feature

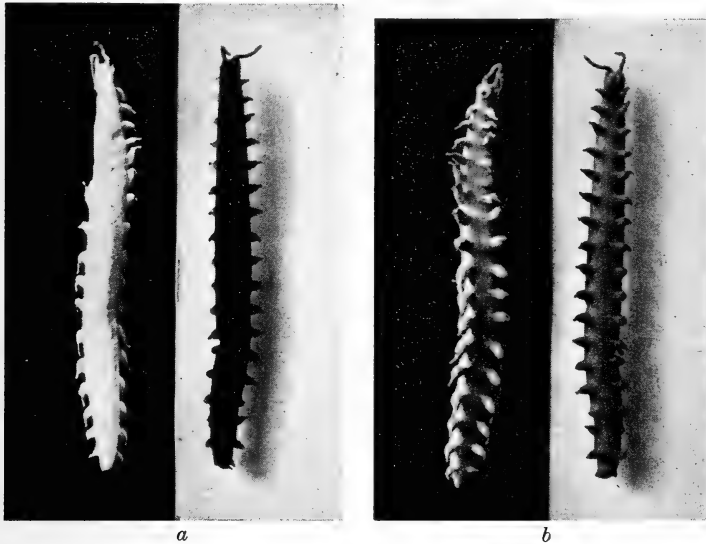


FIG. 3.—a, *Peripatopsis alba* on left, *balfouri* on right, dorsal view; b, the same, ventral view (slightly larger than life size).

of the animal to an observer seeing it for the first time. Purcell described four colour varieties for *P. capensis*, but none of them with any tendency towards albinism.

With regard to the eyeless condition of this Peripatopsid, only one other member of the Onychophora has thus far been recorded displaying a similar absence. In 1914 Kemp described an eyeless form, *Typhloperipatus*, from north-eastern India (Records of the Indian Museum, vol. viii, pt. 6, p. 471). These specimens were found only under stones on hilly sloping ground at an altitude ranging from 1200 to 2000 feet, a habitat almost precisely identical with that of our normal-eyed Peninsula species *P. capensis* and *P. balfouri*. In *Typhloperipatus*, of a large number of specimens captured, both the adults and the young were normally pigmented, and it would

therefore seem that if the eyeless and unpigmented conditions are recessive mutant characters in Onychophora, they are not linked characters. Kemp described a patch of flat lanceolate scales on the ventral surface of the antennae, considering these to be "tactile in function, compensating in some degree for the complete loss of sight"; such a structure does not exist in *Peripatopsis alba*. A section through the brain showed in the case of *Typhloperipatus* a well-developed optic ganglion, but there was no differentiation of the epidermis to form a cornea, and no trace of a lens or retina; owing to the paucity of material it has been impossible to repeat this investigation or to give any account of the internal anatomy in the case of *Peripatopsis alba*.

The occurrence of unpigmented and blind animals living in darkness has been so thoroughly discussed by differing schools of evolutionary thought that it would be futile to add to the already immense literature on the subject. It only remains to add that no member of the Onychophora has as yet been found living in such a habitat as *Peripatopsis alba*, and that it is probably the most typical cavernicolous animal that has yet been encountered in South Africa. This environment is an ideal one for Onychophora as far as physical conditions go; there is a constant supply of water percolating into the caves throughout the driest seasons of the year, providing that uniformly high degree of humidity and an almost constant temperature within very narrow extremes, both of which factors occurring together provide optimum conditions for Onychophora. Animals living under these conditions are exempt from two catastrophes which destroy numbers of Onychophora in the Cape Peninsula every year—mountain fires and droughts.

Owing to the increase of population and the taking over of waste land for habitable purposes there is a danger of *Peripatopsis* tending towards extinction in the Cape Peninsula. It is now only found in the less frequented ravines and slopes of the mountain. Moseley demonstrated the tracheate nature of *Peripatus* with specimens which he captured behind Coghill's Hotel at Wynberg in 1873; such a capture would be an impossibility at the present day. In a small ravine on the Camps Bay side of Kloof Nek, near Lion's Head, the author a few years ago collected twenty-four specimens in a couple of hours; since the municipality have cleared and drained the spot, providing amenities for picnic parties and sightseers, no specimen of *Peripatopsis* has ever been found, though repeated search has been made. *P. leonina* is almost if not totally extinct owing to

numerous fires and the planting of pine tree forests on Signal Hill, the only locality where it has ever been known to exist.

Key to the Species of Peripatopsis.

1. Last pair of legs with neither claws nor rudiments of feet 2.
 Last pair of legs with normal feet and claws 3.
2. 17 pairs of claw-bearing legs *capensis*, Grube.
 21-22 pairs of claw-bearing legs *moseleyi*, Wood-Mason.
3. Eyes absent, body unpigmented *alba*, n. sp.
 Eyes present, body pigmented 4.
4. Many of the papillae of the upper part of the body clavate, being enlarged
 in the apical part; 17 pairs of claw-bearing legs . . . *clavigera*, Purcell.
 None of the dorsal and lateral papillae clavate; 18 or more pairs of claw-
 bearing legs 5.
5. 18 or 19 pairs of claw-bearing legs 6.
 20-22 pairs of claw-bearing legs 7.
6. Coxal glands present in legs 1-16 *intermedia*, Hutchinson.
 Coxal glands not present in legs 1-16 *balfouri*, Sedgwick.
7. 20 pairs of claw-bearing legs *sedgwicki*, Purcell.
 21-22 pairs of claw-bearing legs *leonina*, Purcell.



6. *On a Collection of Stone-flies (Order Perlaria) from South Africa—*

By R. J. TILLYARD, M.A., Sc.D. (Cantab.), D.Sc. (Sydney),
F.R.S., F.L.S., F.G.S., F.E.S., F.N.Z.Inst., C.M.Z.S.

(With 13 Text-figures.)

THE subject of this paper is a small collection of stone-flies received for study from the South African Museum, Capetown, through the kindness of Dr. E. L. Gill, Director of the Museum. Most of the specimens were collected by Dr. Barnard, Assistant Director, in the course of his researches on the fauna of the Cape mountain ranges. The collection has proved to be of very great interest both from the systematic and the zoogeographical view-points. The probable existence of a group of PERLARIA of southern (Notogaean) origin was suggested by me (*in litt.*) from the study of the known Perlarian faunas of other southern lands, *e.g.* Australia, New Zealand, and Southern Chile; but it would have been impossible to indicate in detail its probable composition beyond stating that any or all of the three known southern or Notogaean groups would be represented in it. These groups are as follows:—

1. The ancient and extremely restricted family AUSTROPERLIDAE (Tillyard, 1921). As this family lies undoubtedly very close to the actual original stem-form of the whole Order, and is to-day only represented by a single genus, *Austroperla*, in New Zealand, and another closely allied genus, *Tasmanoperla*, in Tasmania and the mountains of South-eastern Australia, one would scarcely expect to find it in South Africa. No representatives of it occur in the present collection.

2. The dominant southern family LEPTOPERLIDAE. This group, consisting for the most part of small, inconspicuously coloured forms, is abundant in New Zealand, particularly in the South Island, in Tasmania, the colder parts of South-eastern Australia, and the colder mountainous regions of South America, including Tierra del Fuego. It has a typical Notogaean distribution and is undoubtedly of southern origin. It appeared to me that there might easily be found representatives of this group in South Africa, and I must admit that it was

mainly with the expectation of discovering such forms that I begged Dr. Barnard to search the mountainous regions of the Cape Province for these particular stone-flies. Nevertheless, no specimens of this family occur in the collection before me, and it seems now extremely doubtful that they occur there at all. We must, however, remember that, although this family is extremely well represented on the mainland of Australia, it remained undiscovered for very many years, owing to the fact that most of the species are very dull, retiring insects, seldom found on the wing, and mostly occurring in late winter or early spring. In Tasmania and New Zealand they are far too abundant to escape notice, and have been known for a much longer period.

3. A small group of peculiar genera belonging to the widespread family NEMOURIDAE (*s. lat.*) and consisting of the genera *Udamocercia* End. (1909) from Tierra del Fuego, *Spaniocerca* Till. (1923) from New Zealand, Tasmania, and South-eastern Australia, and *Notonemoura* Till. (1923) from New Zealand only. These are very small stone-flies, even more inconspicuous than the smaller species of LEPTOPERLIDAE, along with which they usually occur, but in much smaller numbers. I anticipated that some form closely related to *Spaniocerca* would probably occur on Table Mountain and other elevated parts of Cape Province, and in this I have not been disappointed. The present collection contains no less than four species belonging to this group and referable to two distinct genera, both new to science. Dr. Barnard is to be highly congratulated on bringing this interesting group to light.

The systematic interest of these new forms lies in the fact that they undoubtedly form a link between the family NEMOURIDAE (*s. str.*) and the small family LEUCTRIDAE. Enderlein, who defined the first genus of the group, viz. *Udamocercia* (1909), does not accept the opinion of most European specialists that the genus *Leuctra* should constitute a distinct family. He takes all the Nemouroid forms as constituting a single family, NEMOURIDAE (*s. lat.*), which he divides into two subfamilies, TAENIOPTERYGINAE and NEMOURINAE, on the form of the tarsi. (See fig. 2, in TAENIOPTERYGINAE the three segments of the tarsus are nearly equal in length). Other European authors, however, tend more and more to treat the TAENIOPTERYGIDAE as a distinct family, and also separate out the somewhat aberrant genus *Leuctra*, which, on its tarsal characters, belongs to the subfamily NEMOURINAE, as a distinct family of its own, LEUCTRIDAE.

It appears to me that Enderlein takes the wider and sounder

view of the problem. Those authors who study chiefly the European forms cannot fail to note the differences between *Leuctra* and the rest of the European NEMOURINAE, and therefore they tend to separate them out into two distinct families. *Nemoura* itself, including all its component subgenera (which are sometimes considered as good genera) stands out as the most highly evolved member of the whole group, particularly in the highly developed "X-form" venational grouping at and below the endings of the subcosta in both wings. *Leuctra* is also a highly developed type in quite another direction; its venation has never developed the "X-form," but it has specialized in the reduction of the anal area of the hind-wing. It is not possible, logically, to fit any of the three known southern genera into either the *Nemoura*-group or the *Leuctra*-group; they lie just about halfway between them. The new forms discovered in South Africa share this character also. The first question one puts to oneself is "Are these forms NEMOURIDAE or LEUCTRIDAE?" The answer is "Neither." The next question is, whether a new family or subfamily group should be made for them. At this point I feel compelled to join forces with Enderlein, and to point out that it seems most logical to conclude that we are, after all, only concerned with a single complex of family rank, the NEMOURIDAE, into which all these allied forms should go. It then becomes apparent that, as in so many other cases, the southern group of genera is nearest to the original type of the family, and that, in working its way into the Northern Hemisphere, this same group has evolved into at least two, or perhaps (if the TAENIOPTERYGIDAE be included) three distinct types. Even so, I am unable to grant subfamily rank to the genus *Leuctra*, for to do so would again place us in a quandary as to what to do with the southern genera, which share almost equally *Nemoura*-like and *Leuctra*-like characters.

My conclusion, then, is that these forms are to be classified as NEMOURIDAE. On the form of the tarsi, they belong to the subfamily NEMOURINAE, as also does the genus *Leuctra*.

In the collection before me another group of stone-flies is represented, viz. the family PERLIDAE, subfamily NEOPERLIDAE, by a single genus and species. This differs from the other species in the collection in being a larger and more striking form, found further north, and evidently of tropical origin. Thus we find in this restricted South African Perlarian fauna the same two elements, broadly speaking, as we find in Australia, New Zealand, and South America, viz. a true southern or Notogaean remnant and a northern immigrant

race, though the latter does not belong to the group (EUSTHENIIDAE) which occurs in other southern countries.

As a fair amount of the material sent was in alcohol, and as it is impossible to define small and obscure species of stone-flies without careful preparations and mounts, the types of all the new species have been dissected and mounted on slides. The wings are first of all dissected off, cleared and mounted in Canada Balsam. The body is then macerated in 10 per cent. KOH solution, cleared and mounted separately. Where available, both sexes have been thus treated. Pinned specimens are considered as paratypes.

NOTE ON VENATIONAL NOMENCLATURE IN THE ORDER PERLARIA.

It has by now been satisfactorily established that the Order PERLARIA as it exists to-day is a small offshoot of the originally more dominant Order PROTOPERLARIA (family LEMMATOPHORIDAE) so well represented in the Lower Permian Beds of Kansas (Tillyard, 1928a, 1928b). An analysis of the various types then extant indicates clearly that the genus *Artinska* Till. contains within itself all the necessary ancestral characters for the modern Order PERLARIA. It is logical to assume that all the other Lower Permian genera died out, and that *Artinska* itself, by further specializations, gave rise at some later geological date to the first true representatives of the Order PERLARIA. These cannot have been very different from the existing family AUSTROPERLIDAE.

The study of the Order PROTOPERLARIA resolves some outstanding puzzles in the venation of PERLARIA. Long ago Comstock (1918, p. 249) wrote as follows:—

“I am convinced . . . that only the first forking of the radial sector, the division of this vein into veins R_2+3 and R_4+5 , is primitive (*i.e.* for the PERLARIA); and that in those cases where the radial sector is more than two-branched, the additional branches have been developed secondarily.

“It is also evident that only the first forking of media, the division of this vein into veins M_1+2 and M_3+4 , is primitive, for the farther branching of these veins is too inconstant and erratic to be considered primitive.”

As Comstock had postulated, for his hypothetical ancestral type of wing-venation, a four-branched Rs and also a four-branched M, the above facts remained for him an unsolved puzzle.

Now in all the PROTOPERLARIA the vein called M by Comstock

proves to be compounded of Lameere's two elements, viz. the anterior convex vein MA and the posterior concave vein MP. Further, it is universally true in this fossil Order that MA in the hind-wing is fused basally for a stretch with Rs. In modern PERLARIA (see figs. 1, 3, 13) such a fusion is universally present in the hind-wing between Rs and the assumed vein M of Comstock. Moreover, in all PROTOPERLARIA, both in the fore- and hind-wings, MP is seen to be *in process of degradation*, its basal portion having lost its chitinization and having become a mere concave groove in the wing membrane. The logical outcome of this process, if continued further, would be to eliminate this vein altogether, and to leave, in consequence, a rather wide field between veins MA and Cu₁. *The more archaic types of existing PERLARIA have such a broad field.* In *Artinska* we can see that already the cross-vein formation is leading up to the alignment of a series of medio-cubitals and inter-cubitals, as in recent PERLARIA. Also, in *Artinska*, there remain many types with MA in the fore-wing still quite separate from Rs, though the tendency to fuse basally with that vein, already achieved in the hind-wing, is seen to be actually consummated in many types of PROTOPERLARIA. Further, *Artinska* has both MA and Rs basically two-branched, which is the condition postulated by Comstock as ancestral for the Order PERLARIA.

An examination of any archaic type of PERLARIA, *e.g.* one of the AUSTROPERLIDAE or EUSTHENIIDAE, indicates the strong convex nature of the vein called M by Comstock. This vein, however, is always a concave vein in other Orders. Thus we arrive at a complete proof that the media of the PERLARIA is the convex vein MA of Lameere, and that the concave vein MP (Comstock's M) has been suppressed long ago.

A further point of interest is that all PROTOPERLARIA possess only *two* anal veins in the fore-wing, 1A and 2A, both convex. In the hind-wing, 1A is simple; 2A forms a four-branched *anal fan*, of which the first branch is forked. This agrees with the tracheation of nymphal wings of PERLARIA. The vein called 3A by Comstock is merely a branch of 2A, secondarily developed.

In view of the above evidence I have labelled the media in this paper MA, using the notation MA₁ and MA₂ for its two primary branches; and I have also discontinued the notation 3A in the system of anal veins.

FAMILY PERLIDAE.

Subfamily NEOPERLINAE.

Enderlein (1909) defines the subfamily NEOPERLINAE by the following characters :—Only two ocelli present. Two axillary veins (*i.e.* a forked 2A) run out from the basal anal cell in fore-wing. Beyond the anastomosis (*i.e.* transverse cord) in fore-wing, Rs is usually three-branched, seldom two- or four-branched.

The absence of the median ocellus and the forked nature of the vein 2A in fore-wing appear to be sound characters on which to base this subfamily. There is, however, so much variation in the venation of that part of the wing distad from the transverse cord that I think the condition of Rs should be omitted from the definition.

Genus OCHTHOPETINA End.

1909. Stettin, Entomol. Zeit., 70 Jahrg., p. 324.

This genus was separated off from *Neoperla* Needham by Enderlein to contain the Ethiopian and Oriental species originally included within *Neoperla*. The type of the latter genus is *N. clymene* (Newm.) from North America, and it originally included species also from South America as well as Africa and Malaya. The North American forms are easily distinguished from all the rest by the fact that, in the hind-wing, the fused basal portions of veins Rs and M (fig. 1, Rs+M) is very short, whereas in the other forms it is much longer, either about equal to, or longer than, the forked parts of these veins proceeding from it to the transverse cord. The genus *Ochthopetina* End., type *O. aëripennis* End. from Java, is distinguished from the genus *Macrogynoplax* End., which includes the South American species, by the short subgenital plate of the female; in *Macrogynoplax* this plate is double as long as the rest of the sternite, and nearly reaches the posterior border of the tenth sternite.

As I have not seen any of the Oriental species of *Ochthopetina*, I am not able to criticise Enderlein's placing of the Ethiopian and Oriental forms together in one genus. If they are really as closely related as Enderlein's grouping would lead us to suppose, the fact is of considerable interest, as it reinforces a large number of similar cases in other groups of insects.

Ochthopetina transvaalensis (End.).

(Fig. 1.)

1909. Zool. Anz., xxxiv, p. 402 (Zoutpansberg).

Of this apparently widespread species the collection contains five specimens: two from M'fongosi, Zululand, collected by W. E. Jones, March 1911, and three from Otjimbumbe, Kunene River, South West

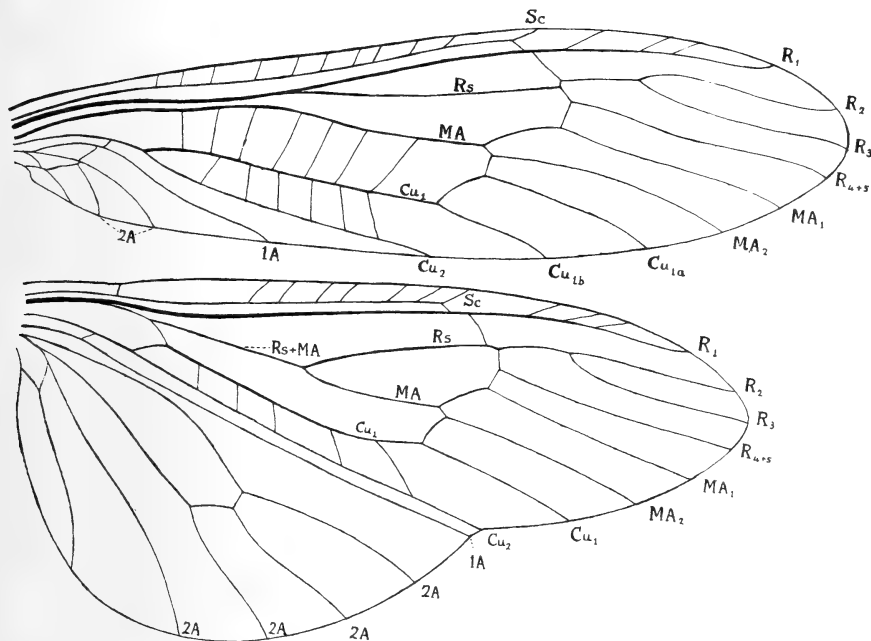


FIG. 1.—*Ochthopetina transvaalensis* (End.). Wings. Length of fore-wing 15 mm. Comstock-Needham System of notation, except MA, anterior or convex media.

Africa, collected by the Museum expedition to South West Africa, March 1923.*

The length of the fore-wing ranges from 13 to 16 mm.; its venation distally from the transverse cord is very variable, and in some specimens M appears to be three-branched, owing to the upper fork of

* There are other specimens in the South African Museum collection from the following localities:—Erikson's Drift, Kunene River (Museum Expedition, March 1923); Lydenburg, Transvaal (P. Kroeger); Howick, Natal (Symons, 1917); Krantz kop, Natal (K. H. Barnard, November, 1917); Upington, Cape (Sollier, 1919).—EDITOR.

Cu_1 becoming transferred to it and the lower fork of the same vein developing an additional small distal fork. Also the most posterior branch of Rs, i.e. R_4+5 , may arise from the transverse cord or it may arise markedly distad from it. Other variable characters are :—the number and position of the cross-veins between M and Cu_1 in fore-wings, and of the intercubitals in both wings ; the length of Sc in hind-wing (sometimes ending close up to the transverse cord, sometimes well short of it) ; the number and position of the pterostigmatic veinlets ; the closeness of the ocelli (sometimes practically touching, sometimes nearly one diameter apart) ; the distinctness of the typical sculpturing of the head and pronotum ; and the size and colouration of the specimen (one specimen from Zululand is markedly darker than the rest).

Attention should be drawn to the peculiar character of vein 2A in the hind-wing (fig. 1). This vein, after approaching very close to 1A at about one-third of its length, bends strongly away from it before it forks at about two-thirds of its length. This character appears to me so peculiar that I think it should be included in the generic definition, if, as I surmise, it occurs in other species of *Ochthopetina*. The Oriental species should be studied also for the condition of this vein.

FAMILY NEMOURIDAE.

Subfamily NEMOURINAE.

The subfamily is easily recognised by the form of the tarsi, in which the second segment is much shorter than either of the other two (fig. 2).

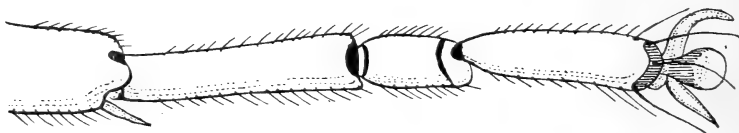


FIG. 2.—*Aphanicerca capensis* n. g. et sp. Middle tarsus with apex of tibia and tibial spur. $\times 100$.

The two new genera represented in the collection may be distinguished as follows :—

Fore-wing with Rs and M arising separately from R ; no striking colour-pattern

Aphanicerca n. g.

(Genotype *A. capensis* n. sp.)

Fore-wing with Rs and M arising together from R ; a striking colour-pattern of

broad dark transverse fasciae present *Desmonemoura* n. g.

(Genotype *D. pulchella* n. sp.).

APHANICERCA n. g.

(Figs. 2-9.)

♂ *Fore-wing* (fig. 3).—Sc ending on costa at or near its middle, and supported either at or just before its end by a cross-vein descending to R_1 and continuous with the transverse cord. Pterostigma very long, without veinlets (rarely an adventitious one, or part of one).

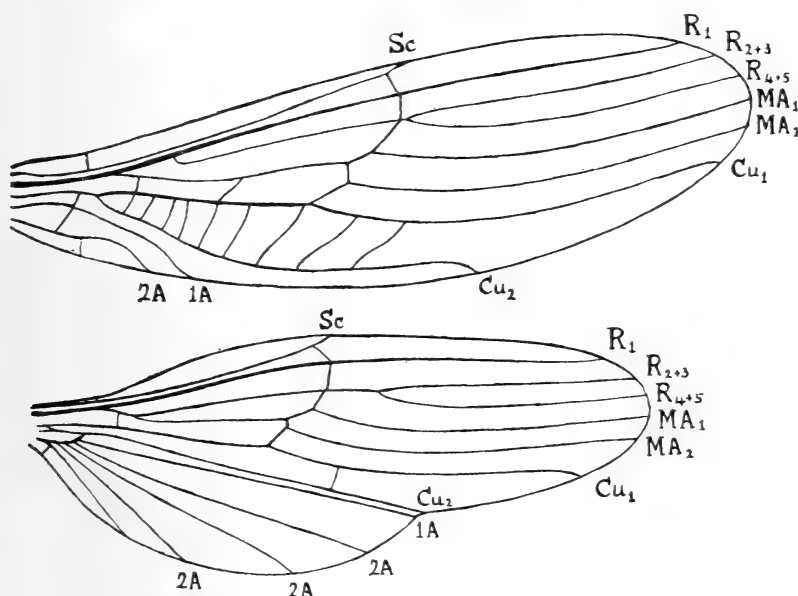


FIG. 3.—*Aphanicerca capensis* n. g. et sp. Wings. Length of fore-wing 7 mm. Venational notation as in fig. 1.

R_s arising from R at a very marked angle (sometimes almost a right angle) at about one-fifth to one-fourth of wing-length, and dividing into two branches, R_2+3 and R_4+5 , either at, or very slightly distad from, the transverse cord. M arising by a much more acute angle separately from R at one-sixth of the wing-length or less from base. Cu_1 simple, extending far beyond end of Cu_2 to a point not far short of apex of wing. All the veins distad from transverse cord very evenly spaced, subparallel; no cross-veins in this part of wing, except an occasional adventitious one just distad of transverse cord between lower branch of M and Cu_1 . Between base and transverse cord, normally only two cross-veins between M and Cu_1 , rarely three.

Eight to eleven intercubital cross-veins, of which two or three lie distad from the lower end of the transverse cord. Only two anal veins, connected not far from base by a strong cross-vein. 1A simple, wavy. 2A with a descending spur about half-way, thence more or less arched.

Hind-wing (fig. 3) with strongly arched costa to end of Sc (at about half-way or slightly less). Rs forking markedly distad from transverse cord. Rs and M arising together from R by a very short common stalk, with descending cross-vein to Cu_1 . A single intercubital cross-vein placed well distad from level of transverse cord. Anal fan narrow, with five simple veins, including 1A; the fifth rather short, and with a very short spur-vein at its base.

Legs with tibia longer than femur; tarsi short, their second segment much shorter than either of the other two.

Cerci vestigial or absent.

Genotype.—*Aphanicerca capensis* n. sp.

This genus shows marked affinity with *Spaniocerca* Till. from Australia and New Zealand, particularly in the mode of origin of Rs and M in fore-wing, in the general structure of the hind-wing, in the form and details of the anal areas of both wings, in the arrangement of the cross-veins between M and Cu_1 in fore-wing, the intercubitals in fore-wing, and the single distally placed intercubital cross-vein in hind-wing. It is easily distinguished by the form of Sc, which, in *Spaniocerca*, arches up to touch the costa and then curves gently down on to R_1 , with an extension in the form of a pterostigmatic veinlet further distad, and also by the absence of the sharp downward curve of Cu_1 on leaving the transverse cord, which is a marked feature of *Spaniocerca*. In these characters one must regard the new genus as being more archaic than *Spaniocerca* itself, though in other respects, notably in the structure of the male genitalia, it appears to be more specialised.

The new genus is also allied to *Notonemoura* Till. from New Zealand, from which it can be distinguished by its narrower and longer wings, narrower anal fan of hind-wing, absence of pterostigmatic veinlets, and form of Sc; this latter vein, in *Notonemoura*, forks evenly at its distal end. *Notonemoura* agrees with *Aphanicerca* in the even arrangement of the veins of the distal part of the fore-wing, but the fork of Rs takes place in such a way that a short portion of R_2+3 is included in the transverse cord, while Rs itself continues through the cord directly along R_4+5 ; in like manner, in *Notonemoura*, a short portion of the upper branch of M forms part of the cord, but M itself

runs through the cord directly into its lower branch. Thus the composition and form of the cord in these two genera is markedly different. This is also true for the hind-wing, where, in *Notonemoura*, the intercubital cross-vein is very small and closer to the base of the cord, the three veins M_3+4 , Cu_1 , and Cu_2 running very close together.

There appear to be three closely allied species of this genus in the collection, which may be distinguished as follows :—

1. Comparatively large species, fore-wing about 8 mm. long, with more or less clearly marked pale irregular band crossing the darker wing about its middle : male with large dorsal processes on abdominal segment 7 . *A. capensis* n. sp.
Comparatively small species, fore-wing 5–6 mm. long, of uniform colouration ; male without dorsal processes 2.
2. Paraprocts of male with paired flagella ; edges of copulatory groove strongly denticulate *A. denticulata* n. sp.
3. Paraprocts without flagella ; edges of copulatory groove only extremely minutely serrate *A. barnardi* n. sp.

Aphanicerca capensis n. sp.

(Figs. 2–4.)

♂. *Total length*, 6·4 mm. ; *hind-leg*, 7 mm. ; *fore-wing*, 7 mm. long by 2 mm. wide. *General colour*, medium brownish fuscous, the head and antennae darker, with a slight russet tinge, the pronotum dark fuscous, the legs brownish tinged with russet, and much darkened towards distal ends of femora ; fore-wings subhyaline tinged with light brownish fuscous, with a markedly more hyaline area, of irregular shape, crossing the middle, just distad from the transverse cord, and much broader posteriorly than anteriorly ; this pattern gives the wings, when folded, a marked appearance of alternate light and dark transverse areas, but too diffuse and irregular to be termed fasciation (contrast the colour-pattern of the wings in *Desmonemoura* n. g. below) ; hind-wings subhyaline.

Head about as wide as pronotum ; *ocelli* very small ; *antennae* (broken) evidently as long as, or longer than, fore-wing, scape large, longer than wide, pedicel about as wide as long but much smaller than scape, third segment subcylindrical, much narrower than pedicel, nearly thrice as long as wide, fourth and following segments much shorter than third, cylindrical, becoming gradually longer towards the distal end of the organ ; thirty-one segments are present in left antenna of holotype male (broken) ; *maxillary palpi* with small first and second segments, third and fourth equal, longer, fifth longer than fourth, oval. *Eyes* black, *occiput* dark russet.

Thorax.—*Pronotum* squarish, slightly broader posteriorly, lateral margins slightly convex, dark fuscous tinged with russet in middle; *pterothorax* considerably wider than prothorax.

Abdomen about 3 mm. long; dorsally from the posterior margin of seg. 7 there is developed a pair of very strong, diverging processes shaped as in fig. 4a, dark brown with black ridges. *Cerci*, 0.3 mm. long, rather slender, hairy, with rounded apices (fig. 4c). *Paraprocts*

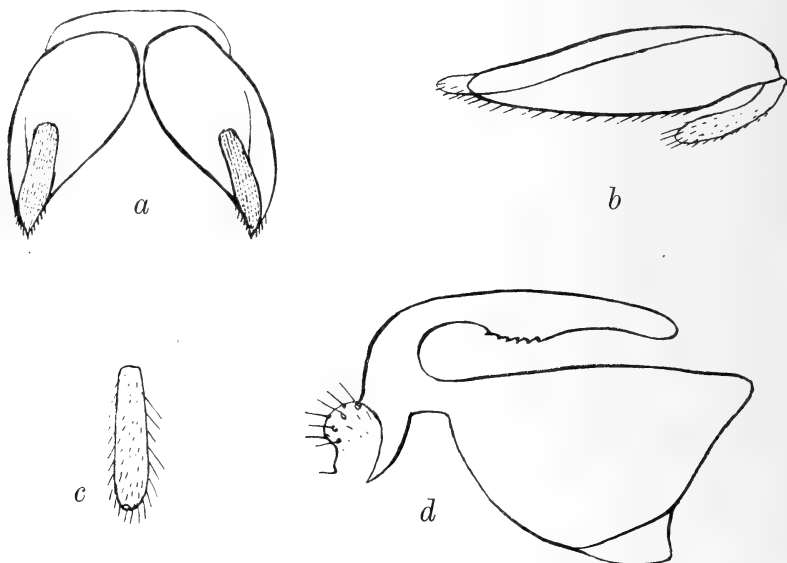


FIG. 4.—*Aphanicerca capensis* n. g. et sp. a, Dorsal processes of segment 7, male. $\times 120$. b, Subgenital plate, male. $\times 60$. c, Cercus, male. $\times 60$. d, Paraproct, male. $\times 60$.

(fig. 4d) 0.4 mm., subtriangular, with a dorsal extension forward from hinder angle in the form of a hard, rather slender process with a slightly enlarged denticulate area on its lower margin; these two processes, in the position of rest, lie close to one another and to the middle line. *Subgenital plate* (fig. 4b) large, sheath-like, its apex somewhat pointed and ending in a softly chitinous flap; a small, softly chitinated process projects below its base.

Wings.—General scheme of venation as given in the generic definition (fig. 3). Of specific value may be noted the very characteristic ending of Sc and also the ending of Cu_2 well beyond half-way along the posterior margin.

♀. Somewhat more robust and darker coloured than male; forewing 7–8 mm. long. Abdomen ending in a pair of broadly triangular

subanal plates, hairy, with moderately pointed and slightly nodding apices; *cerci* very short, broadly rounded at apex, hairy.

Occasional additions to the normal venation are to be seen in both sexes, notably an additional cross-vein above Cu_1 in fore-wing, just distad from transverse cord; an additional (third) medio-cubital cross-vein in fore-wing; a pterostigmatic veinlet, either wholly or only partially formed, just distad from end of Sc in both wings; doubling of the subanal veinlet or strut from 2A to posterior margin in fore-wing.

Types.—Holotype male and allotype female, mounted on slides, the bodies treated with KOH, the wings cleared and mounted separately; both from tube of specimens preserved in alcohol, taken on Table Mountain, by K. H. Barnard, 25th January 1929.

Localities.—Table Mountain, Cape Town (October 1917 and January 1929); Winterhoek Mountains, Tulbagh (August 1929); Wellington Mountains, 4000 feet (December 1924); Jonker's Hoek, Stellenbosch (May 1924). A dark female form, with the pale area of the fore-wings much restricted, was taken at Lemoens Hoek, Heidelberg, Cape Province, in November 1927. A small male, fore-wing only 5.8 mm. long, and a small female were taken at Klein Drakenstein, October 1925. The species is evidently widespread and not uncommon at high altitudes. All specimens collected by K. H. Barnard.

Aphanicerca denticulata n. sp.

(Figs. 5, 6a.)

♂. *Total length*, 6 mm.; *fore-wing*, 5.7 mm. long by 1.8 mm. wide. *General colouration* dull brownish fuscous, head and antennae somewhat darker; legs medium brownish fuscous, femora not markedly darkened apically.

Head.—The *antennae* differ from those of *A. capensis* n. sp. in having the scape almost bulbous, very wide, and not longer than wide, the pedicel only half as wide as the scape, and not longer than wide, the third and following segments not cylindrical, but all somewhat wider distally than basally, the third barely twice as long as wide, the fourth and following segments shorter than the third, but becoming gradually longer distally. Forty-seven segments can be counted on one antenna and forty-five on the other, neither being complete. The *maxillary palpi* have the third segment longest, and both third and fourth are widest distally; the fifth segment is markedly more

pointed apically than in *A. capensis*, and is also the longest segment of the five.

Thorax.—The *pronotum* is markedly wider than long, sub-rectangular, with a fine median longitudinal line.

Abdomen.—There are no dorsal processes as in *A. capensis* n. sp., but there is a median grooved appendage developed below and between the cerci which is not present in *A. capensis*. Viewed ventrally, this

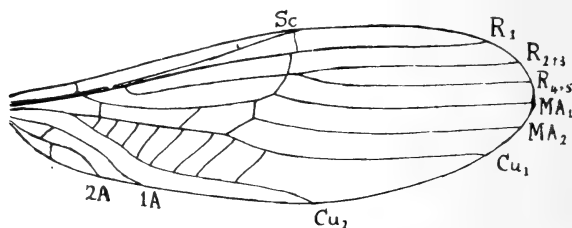


FIG. 5.—*Aphanicerca denticulata* n. g. et sp. Fore-wing. Length 5.7 mm. Venational notation as in fig. 1.

appendage is scissors-shaped (fig. 6a), with the two loops placed posteriorly and the narrow process projecting anteriorly; the sides of this latter are markedly denticulate. The *paraprocts* are much larger, their forward processes weakly chitinized, double. *Cerci* shorter and stouter than in *A. capensis*, hairy. *Subgenital plate* very short, basal appendage minute.

Wings (fig. 5) almost unicolorously tinged with brownish fuscous, slightly darker at base and along costa of fore-wing. Venation closely similar to that of *A. capensis*, but with Sc arching up distally to end in costa exactly at the point where the transverse cross-vein descends to the transverse cord. Cu_2 not quite as long as in *A. capensis*, in fore-wing; in hind-wing the distal intercubital cross-vein is placed nearer margin of wing than base of transverse cord.

♀ unknown.

Type.—Holotype male, mounted on slide, body treated with KOH, wings cleared and mounted separately, from specimen preserved in alcohol, taken on Winterhoek Mountains, Tulbagh, by K. H. Barnard, August 1929.

Aphanicerca barnardi n. sp.

(Figs. 6b, 7–9.)

♂. Total length, 5 mm.; fore-wing, 5.4 mm. General colour brownish. This species is evidently closely allied to *A. denticulata*

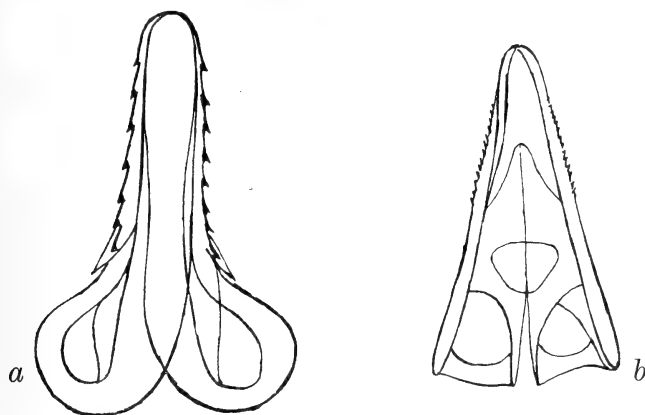


FIG. 6.—*Aphanicerella* n. subg. Dorsal grooved appendage of male, flattened by mounting. $\times 120$. *a*, *A. denticulata* n. sp. *b*, *A. barnardi* n. sp.

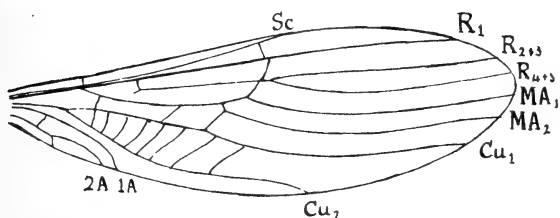


FIG. 7.—*Aphanicerca barnardi* n. g. et sp. Fore-wing. Length 5.4 mm. Venational notation as in fig. 1.

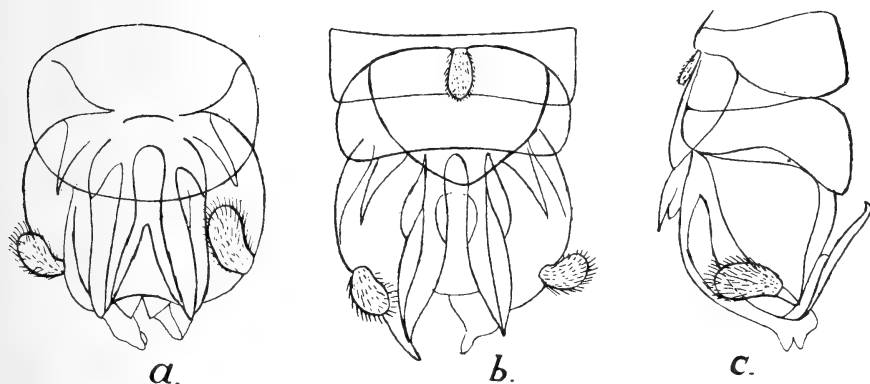


FIG. 8.—*Aphanicerca barnardi* n. g. et sp. Male appendages cleared in KOH 10 per cent. solution, and drawn before mounting. *a* dorsal, *b* ventral, and *c* lateral views.

n. sp., and like the latter differs from *A. capensis* in having no dorsal processes on the abdomen of the male and in possessing a median grooved appendage below and between the cerci. This appendage (fig. 6b) differs in shape from that of *A. denticulata*, and the margins of its anterior process are not denticulate but only very minutely crenulate. The paraprocts also differ in form, their forward processes begin single, strongly chitinized, but ending in rather soft, fleshy projections. Cerci short and stout, larger than in *A. denticulata* and with longer hairs. Subgenital plate broad and well developed, shaped as in fig. 8b, with a short but quite distinct basal appendage. Fig. 8a, b, c shows the very complex male genital region in dorsal, ventral, and lateral view respectively.

Wings (fig. 7) subhyaline, with brownish fuscous veins. The descending cross-vein of the subcosta is placed definitely before the end of that vein. At the curve of Rs in fore-wing, close to its origin, there is a short spur-vein directed basad, suggesting the course of evolution by which, very probably, the fused condition of Rs and M in the fore-wing of the next genus (*Desmonemoura* n. g.) has been attained. Anal area of fore-wing markedly narrower than in *A. denticulata*, the course of IA being different and closer to Cu₂.

♀ closely similar to male in general appearance. Ventrally the abdomen has a transverse hard chitinous area on seg. 7, a divided subgenital plate on seg. 8, a large, partially divided subanal plate on seg. 10, and small, fairly slender, slightly curved cerci, as shown in fig. 9.

Types.—Holotype male, mounted on slide, body treated with KOH, wings cleared and mounted separately, from specimen preserved in alcohol; taken at Fairy Glen, Worcester, Cape Province, by K. H. Barnard, June 4, 1929. Allotype female (abdomen only) similarly treated, from damaged example, same series of specimens. Paratype male, from same locality, mounted entire on slide. Abdominal appendages of ♂, mounted on slide, from damaged specimen in alcohol; also wings and legs on separate slides.

Following the practice of some European authors, the above three species may be divided into two groups having subgeneric rank, as follows :—

- | | |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Male with dorsal processes from seventh abdominal segment, but without a dorsal grooved appendage below and between cerci | Subgenus <i>Aphanicerca</i> n. g.
(Type <i>Aphanicerca capensis</i> n. sp.) |
| Male without any dorsal processes, but with a dorsal grooved appendage below and between cerci | Subgenus <i>Aphanicerella</i> n. subg.
(Type <i>Aphanicerca barnardi</i> n. sp.) |

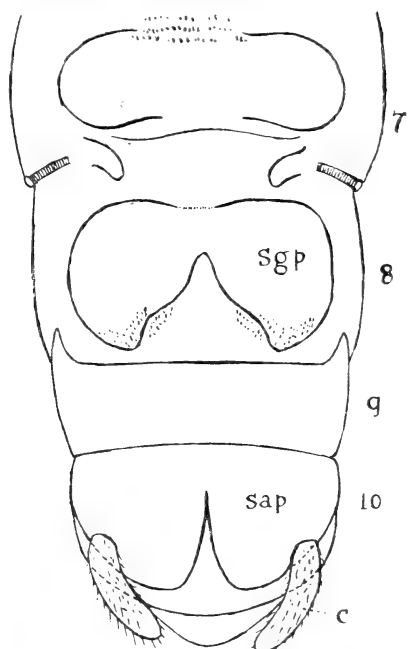


FIG. 9.—*Aphanicerca barnardi* n. g. et sp. Last four segments of abdomen of female, ventral view. $\times 56$.

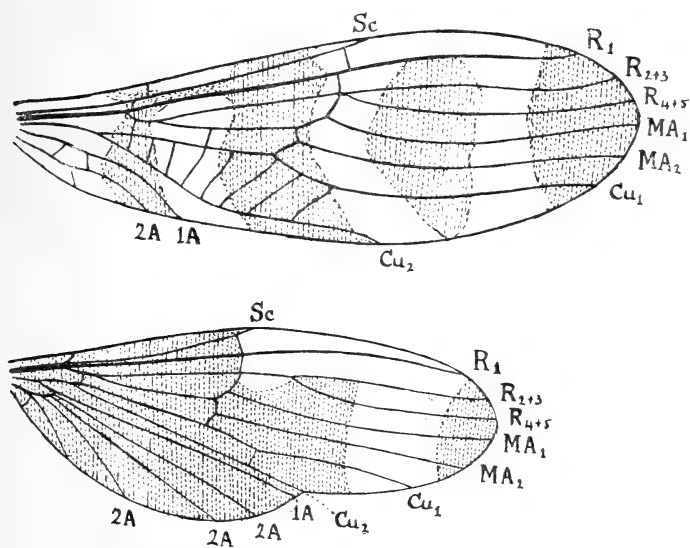


FIG. 10.—*Desmonemoura pulchellum* n. g. et sp. Wings. Length of fore-wing 5.8 mm. Venational notation as in fig. 1.

A. barnardi n. sp. is designated as the type of the new subgenus *Aphanicerella* because both sexes are known and it appears to be a commoner species than *A. denticulata* n. sp.

DESMONEMOURA n. g.

(Fig. 10.)

This genus is to be regarded as a specialised offshoot from the older genus *Aphanicerca* n. g. It differs from it in the following characters:—

Fore-wing with Rs and M arising by a common stalk from R, and with a strongly marked pattern of dark transverse fasciae. Male with very complex terminal appendages, possessing two pairs of forcipate appendages, one pair formed from the cerci and another from the paraprocts.

Genotype.—*Desmonemoura pulchellum* n. sp.

Desmonemoura pulchellum n. sp.

(Figs. 10, 11.)

♂. Total length, 7 mm.; fore-wing, 5.8 mm. long. *General colouration* strongly banded in very pale and very dark brown. Head, pterothorax, and end of abdomen dark brown, prothorax and most of abdomen very pale; legs pale, except last segment of tarsus, which is dark.

Head.—*Antennae* with basal segments somewhat similar to those of *A. capensis* (broken); *maxillary palpi* also similar to those of *A. capensis* in form, but longer, being about as long as the width of the head.

Thorax.—Pronotum rectangular, somewhat wider than long, without a mid-longitudinal line.

Abdomen.—No dorsal processes present. The very complex terminal appendages are shown in ventral view in fig. 11; note the cerci (*c*) forming one pair of forcipate appendages, distinguished by the hairs on their distal portions, and a second pair of forcipate appendages formed from the paraprocts (*pp*), and not hairy; there is also a complex median appendage, a pair of shorter processes, and a triangular subanal plate with small basal hairy process (*bp*).

Wings.—Fore-wing (fig. 10) beautifully banded with irregular transverse fasciae of dark brown on a pale, subhyaline ground. Four

of these bands may be distinguished, the first and third not reaching the costa, and the fourth occupying the apical area of the wing. The second fascia reaches posteriorly to the end of Cu_2 , which is barely beyond the level of the end of Sc. Hind-wing (fig. 10) mostly darkly

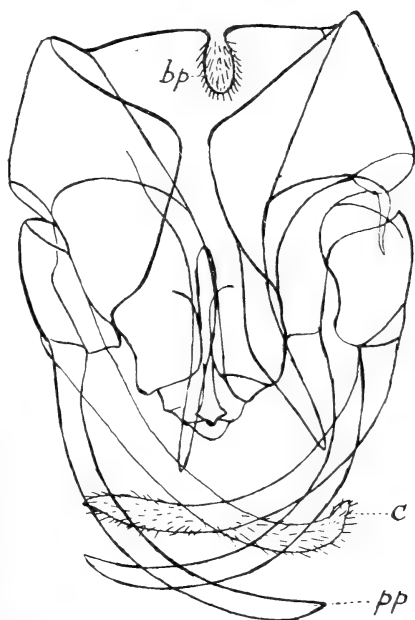


FIG. 11.—*Desmonemoura pulchellum* n. g. et sp. Appendage of male, flattened by mounting. Ventral view. $\times 56$. *bp*, Basal process of subgenital plate; *c*, cercus; *pp*, process of paraproct.

shaded, but with pale, subhyaline area extending along costa from transverse cord to near apex and extending right across to posterior margin covering the apical part of Cu_1 .

♀ similar to male, but without the forcipate appendages; subanal plate divided into two broadly triangular lobes, pale in colour; subgenital plate also pale, shorter.

Types.—Holotype male, mounted on slide, body treated with KOH, wings cleared and mounted separately, from specimen preserved in alcohol, taken at Banhoek, near Stellenbosch, by K. H. Barnard, October 7, 1929. Allotype female, pinned specimen, taken by K. H. Barnard on Winterhoek Mountains, Tulbagh, 4000 feet, November 1917. One paratype from same locality, two from Tradouw Pass, Swellendam, November 1925 (K. H. Barnard).

LARVAE.

(Figs. 12, 13.)

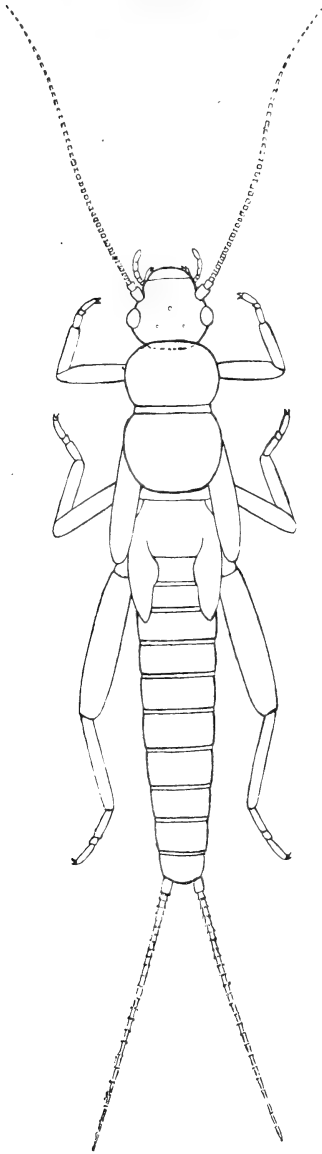


FIG. 12.—Full-grown larva of an undetermined species of *Aphani-cerca* from Banhoek near Stellenbosch. $\times 16$. Missing portions of antennae and cerci restored.

In the collection are two specimens of larvae of *Perlaria* preserved in alcohol, both from Banhoek, near Stellenbosch (taken by K. H. Barnard, October 7, 1929). Neither of these larvae possess any external gills. The smaller of them is in the last instar, and has the venational scheme clearly marked on the wings as pale veins on a fuscous background. It is therefore possible to determine the genus without any doubt, and the venation proves that this larva belongs to the genus *Aphani-cerca*. It is in rather poor condition, with the antennae and cerci badly broken off. After treatment with KOH, the larva was cleared and mounted on a slide, and one of the maxillary palpi was dissected out. Fig. 12 shows the reconstructed larva (length of body 6 mm.), with probable form of antennae and cerci; fig. 13 shows the structure of the maxillary palp. The general colour of this larva is pale brownish, without any pattern.

A comparison with known larvae of *Nemoura* and *Leuctra* shows that this larva is, as might be expected, somewhat intermediate between the two. In its general form it comes closest to *Nemoura*, particularly in the large and robust legs and robust build of thorax. The mandibles have both incisor and molar series of teeth strongly developed, but the ciliation of the inner margin is only poorly developed. The maxilla differs from that of both *Nemoura* and *Leuctra* in that the galea

and lacinia are just about of equal length; in these other genera the galea is the longer, especially in *Nemoura*. The maxillary palp has the distal segment longest, rather narrow oval in shape, somewhat pointed (fig. 13).

The larger larva, which is in better condition, was cleared and mounted without treatment by KOH. It is in the penultimate instar and therefore its generic position cannot be determined from the wing-venation. As, however, the colouring is medium brown on the thorax and legs, with the head and most of the abdomen markedly darker, it is reasonable to suppose that it belongs to the strongly banded species *Desmonemoura pulchellum* n. g. et sp., adults of which were taken by Dr. Barnard along with it. Length of body, 7.2 mm.; antenna, 4.8 mm.; cerci, 3.8 mm. The general form is very similar to the smaller larva, but there are some important differences, as follows: The maxillary palpus has the last segment narrow, cylindrical, with apex bluntly rounded; the pronotum is more rectangular, markedly wider than long; the legs are even more robust than in the smaller species, and in particular the femora are much broader, with a flattened fusiform outline; the tenth segment of the abdomen is divided or notched medially, and the paraprocts are very hairy; the antennae and cerci are much as in the restoration of the smaller larva in fig. 12, the segments of the cerci having whorls of a few short hairs at the apex (omitted in the figure).

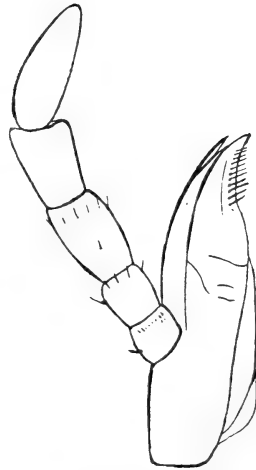


FIG. 13.—First maxilla of the larva, shown in fig. 12, of an undetermined species of *Aphanicercus* n. g. $\times 90$.

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7. *New South African Solifugae*.—By R. F. LAWRENCE, B.A., Ph.D.,
Assistant in Charge of Arachnida.

(With 4 Text-figures.)

THE following paper consists of descriptions of two monticolous forms of Solpuga. Previously 3 new species of Solpuga and 1 of Blossia have been described (Ann. S. Afr. Mus., vol. xxix, pt. 1, p. 153) from altitudes of 4000 feet and over on the mountain ranges of the Cape system. These and the following species seem to point to the fact that a rich and peculiar Solifugid fauna inhabits the higher altitudes of these mountains. A new species of Daesia is described from the Garies region in Little Namaqualand.

Gen. SOLPUGA, Licht.

Solpuga cycloceras, n. sp.

(Fig. 1, a-c.)

3 ♂♂, Swartberg Pass, near Oudtshoorn, 5000–6000 feet altitude.

Colour.—Headplate, mandibles, thoracic tergites reddish brown,

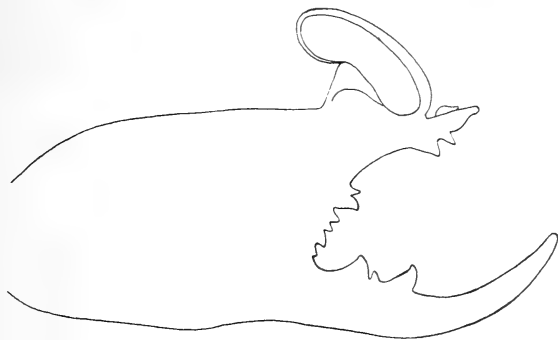


FIG. 1, a.

palps and legs reddish brown, the distal segments (especially in fourth leg) blackish; abdomen above blackish in the middle with a few coarse yellow hairs, sides reddish brown, thickly covered with silvery yellow hairs; sternites of abdomen light yellow-brown,

blackish at the sides, covered with light yellow hairs; fourth pair of legs with long golden-yellow hairs; malleoli narrowly margined with black.

Flagellum as in fig. 1, *a, b, c*; basal enlargement high, almost triangular; narrowed portion seen from the side rising from a point just posterior to the second tooth of the upper jaw, widest just above its origin, and then tapering finely and regularly to a point which is provided with a small transparent membrane near its tip (fig. 1, *b*). Seen from above the width tapers regularly to its distal apex.



FIG. 1, *b, c*.

Dentition.—Apex of upper jaw short and rather blunt at its tip, provided above on its inner side with a short keel or crest bearing a small tooth at its apex (fig. 1, *c*); outer series of teeth of the upper jaw as in fig. 1, *a*, inner series consisting of a fairly large distal tooth separated by a space from 2 small proximal teeth the second of which is very minute.

Spination.—Mandibles at the sides and in the distal half above with stout, erect, apically cleft setae, upper and lower jaws on inner side lined with 1 or 2 rows of feather bristles; about 12 stridulatory ridges; headplate sparsely provided with stout, erect, apically cleft setae, posteriorly with long coarse and wavy setose hairs; between these a fairly dense covering of much shorter prickly setae; thoracic tergites with long coarse wavy hairs; legs with some long silky hairs, especially in the fourth pair (these however not forming a mane); metatarsus of palp scopulated below except in basal fifth.

Measurements.—Total length of largest specimen, 25 mm.; mandible, 6.5 mm.; width of headplate, 5.5 mm.; tibia of palp, 5.7 mm.; metatarsus+tarsus of palp, 6.8 mm.; total length of smallest specimen, 22 mm.

Solpuga brachyceras, n. sp.

(Fig. 2, *a, b*.)

1 ♂, Swartberg Pass, near Oudtshoorn, 5000–6000 feet altitude.

Colour as in *S. cycloceras*.

Flagellum as in fig. 2, *a*, seen from the side; basal enlargement fairly low and bluntly rounded; shaft of flagellum short, rising

just posteriorly to the second large tooth of the upper jaw; at its base the axis of the flagellum is turned obliquely laterally so that almost the entire anterior surface is seen from the side; the proximal half does not taper so suddenly as the distal half, which ends in a fairly fine point; there are no serrations, but the anterior surface of the shaft is faintly striated in its proximal two-thirds.

Dentition.—Fang-tip of upper jaw with a keel above on the inner side (fig. 2, *b*) more prominent than that of *S. cycloceras*; a distinct tooth between the apex of fang and the two first teeth, remaining

FIG. 2, *a*.FIG. 2, *b*.

teeth of the outer series as in *S. cycloceras*. The inner series cannot be seen.

Spination.—Mandible above in distal half with stout, erect setae, these not present at the sides; 10–11 stridulatory ridges; headplate with a few stout erect setae anteriorly, posteriorly and at the sides with long coarse wavy hairs; legs with some long silky hairs, fourth leg without a mane; metatarsus of palp scopulated below except at the apex and basal fifth.

Measurements.—Total length, 20 mm.; mandible, 5.7 mm.; width of headplate, 4.5 mm.; tibia of palp, 5 mm.; metatarsus+tarsus of palp, 6 mm.

Both the preceding species come under the *lateralis*, *erythronota*, *erythronotoides*, *intermedia* group.

Gen. DAESIA Karsch.

Daesia gariesensis, n. sp.

(Fig. 3, a-c.)

1 ♂, Kamieskroon; 1 ♀, Garies, Little Namaqualand.

♂. *Colour*.—Headplate with deep violet infuscation, except for a small round yellow spot on each side of the ocular tubercle, and a

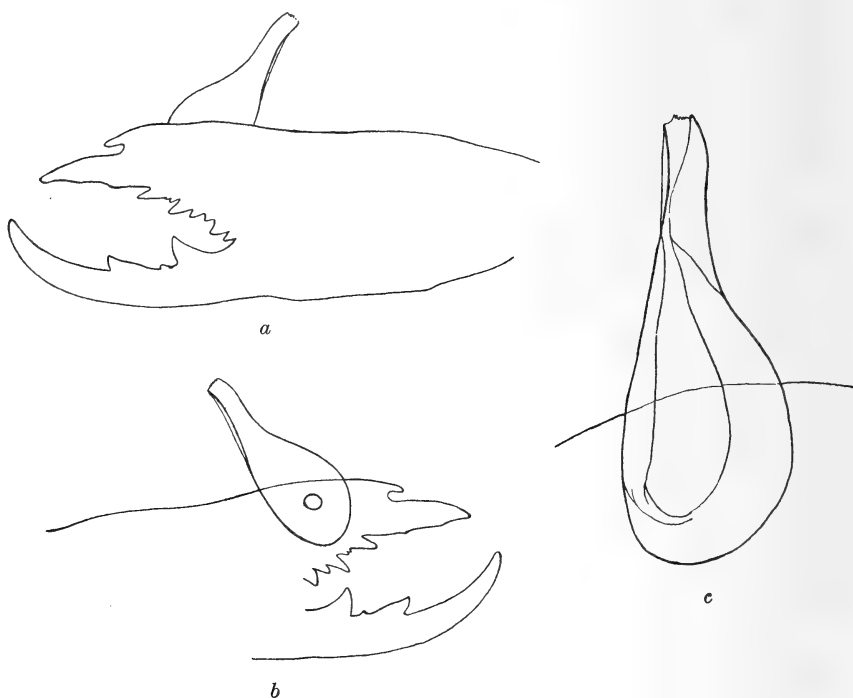


FIG. 3, a-c.

large trilobed yellow marking in the middle (the middle lobe much larger than the lateral lobes); mandibles yellow, with 3 longitudinal blackish stripes united distally by an obliquely transverse thicker blackish stripe, inner side of mandible with an obliquely transverse blackish stripe distally, not as long as the corresponding stripe on the outer side; abdomen above with 3 longitudinal blackish stripes composed of a spot on each tergite, below with a faint blackish stripe at the sides of the terminal tergites; appendages infuscated violet,

especially palps and fourth leg, femur of palp not infuscated except at apex, and an inferior stripe on inner side.

Flagellum as in fig. 3, *a*, *b*, *c*; when rotated forwards the tip of the flagellum falls short of the fang-tip by a little; seen from the inner side (fig. 3, *b*, *c*), the inner surface is slit along its distal third, the edges of the aperture being finely membranous, transparent, and slightly frayed, the apex is cup-like, with a finely serrated edge; seen dry (fig. 3, *c*), the circumference of the flagellum is a fairly wide raised flange enclosing an oval anteriorly pointed shallow depression; at the point where the flagellum suddenly narrows the flange is folded on itself.

Dentition as in fig. 3, *a*, seen from the outer side; upper jaw in front of flagellum with a pointed tooth directed slightly outwards; outer series of the upper jaw with the first large tooth followed by 2 small intermediate teeth, the first of these minute; inner series consisting of 2 larger alternating with 2 smaller teeth; lower jaw with 2 minute intermediate teeth between the two main teeth, the first of the former almost imperceptible; 7 or 8 stridulatory ridges.

Spination.—Mandibles especially in the anterior half with some stout setae above and at the sides; headplate with a few slender setae; metatarsus of palp on inner side below with a stout truncated spine at apex and four setose spines becoming more slender proximally, outer side with a row of 3 truncated spines distally and 2 setae proximally; tibia below with a row of 4 long curved setae on each side, femur below with a row of about 6 similar setae on inner side. Abdomen more thickly covered with hair at the sides than in the middle above.

Measurements.—Total length, 18 mm.; mandibles, 4 mm.; width of headplate, 3.6 mm.; tibia of palp, 5.8 mm.; metatarsus+tarsus, 6.5 mm.

A single female from Garies (about 12 miles from Kamieskroon) without doubt belongs to the same species as the above male.

♀. *Colour* as in ♂.

Dentition.—Upper jaw with two large main teeth followed by 2 small intermediate teeth, the first slightly smaller than the second, then another large main tooth followed by 4 moderate ones; lower jaw with 1 small intermediate tooth; metatarsus of palp spined as in ♂, tibia below on each side with 3 very long, stout, almost prone setae (those of ♂ almost erect) springing from large tooth-like

processes, these setae much stouter than in ♂; femur at inner apex below with 1 similar seta.

Measurements.—Total length, 22 mm.; mandible, 5 mm.; width of headplate, 4·5 mm.; tibia of palp, 4·8 mm.; metatarsus+tarsus, 5·6 mm.

This species differs from allied forms such as *hottentotta*, *lineata*, *pearsoni*, in having a distinct tooth on the dorsal surface of the upper jaw.

8. *Some Collembola of the Family Sminthuridae from South Africa.*

—By H. WOMERSLEY, A.L.S., F.E.S. (Division of Economic Entomology, Australian Council for Scientific and Industrial Research).

(With Plates VIII–XIII.)

THE species recorded and described in this paper comprised a number of specimens collected by myself during a short period in Cape Province during August and September 1930, as well as a number in the collection of the South African Museum, Cape Town. For the opportunity of studying this latter collection I am indebted to Dr. L. Gill, Director.

Altogether some six species and two varieties are here recorded from South Africa. They are as follows :—

Sminthurinus niger Lubbock.

„ *terrestris* sp. n.

„ *pallidus* sp. n.

Rastriopes lineata sp. n.

Deuterostminthurus marmoratus sp. n.

„ „ var. *barnardi* n.

Dicyrtomina minuta O.F. form *africana* n.

ORDER COLLEMBOLA Lubb.

SUBORD. SYMPHYPLEONA C.B.

FAMILY SMINTHURIDAE Lubb.

Subfam. SMINTHURIDINAE C.B.

Genus *Sminthurinus* C.B.

Sminthurinus niger (Lubb.).

(Plate VIII, figs. 1–6.)

1873. Lubbock, Monogr. Collemb., p. 111, pl. vi.

A number of specimens of this well-known European hot-house species were found under the loose bark of a fallen log at Stellenbosch,

C.P., 12/8/30. Although not previously known from South Africa, it was recorded by Wahlgren in Results of the Swedish Zool. Exped. to Egypt and the White Nile, 1901, as having been found under leaves near Cairo.

Sminthurinus terrestris sp. n.

(Plate IX, figs. 1-5.)

Diagnosis: Size 1.5 mm. Colour uniformly deep blackish violet. Appendages somewhat lighter (fig. 1).

Eyes 8+8, on deeply pigmented patches. Antennae nearly half as long again as the head; ratio of head diag. : ant. I : II : III : IV = 11 : $1\frac{1}{2}$: 3 : 4 : 7; ant. IV unringed with small terminal knob; protuberance on ant. III small and simple as in *Sminthurinus aureus* Lubbock.

Legs of normal length; tibiotarsus with three fine clavate hairs (figs. 2, 3), which are only half the length of upper claw. Claws similar on all feet. Upper claw (figs. 2, 3) with a single inner tooth slightly beyond the middle and with an outer sheath distally. Basally the outer edge of upper claw is finely serrated as in *Sminthurus niger* Lubbock. Lower claw with broad, somewhat angular inner lamella and subapically with a fine seta reaching to apex of upper claw.

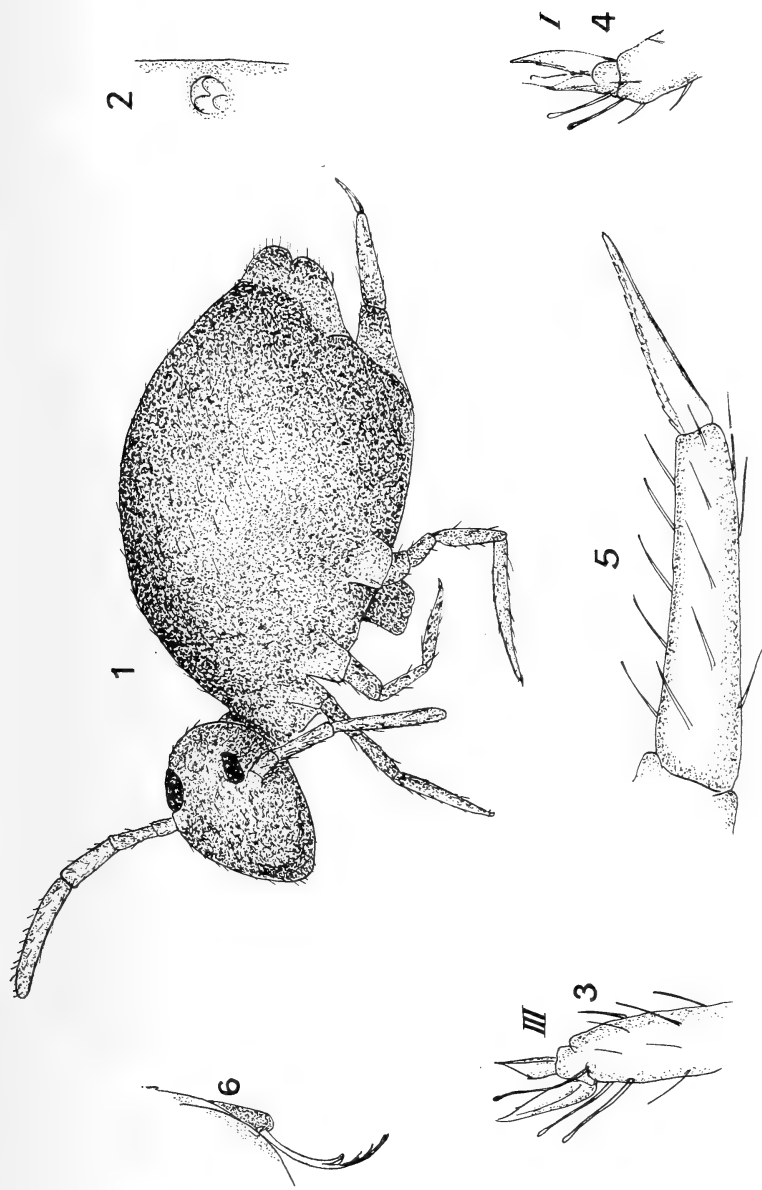
Furca short; ratio of dentes to mucro = $5\frac{1}{2}$: 2; mucro with inner edge of lamella finely serrated (fig. 4). Ratio of mucrodens to hind tibiotarsus = 8 : 8.

Genital appendage of female fimbriated (fig. 5).

Clothing of short and sparse setae.

This species was extremely abundant on the surface of the ground beneath a strong growth of Cape Weed (*Cryptostemma calendulaceum*), both in the University Orchard at Stellenbosch and in a similar habitat at the Marsh Memorial Homes at Rondebosch. My dates are for Stellenbosch 24/7/30 and 22-24/8/30 and for Rondebosch throughout August 1930.

Co-types in the South African Museum, Cape Town.



Figs. 1-6.—*Sminthurinus niger* Lubb.





FIGS. 1-5.—*Smintharus terrestris* sp. n.



Sminthurinus pallidus sp. n.

(Plate X, figs. 1-7.)

Diagnosis: Size 0.9 mm. Colour entirely of a light yellow with no pigment even on the eye patch (fig. 1).

Eyes 8+8, two being much smaller than the rest (fig. 1).

Antennae longer than the head; ratio of head diag.: ant. I: II: III: IV=8:1:1½:2½:5; ant. IV slightly clavate and unringed; ant. III with the wart-like prominence trilobed (fig. 2), and subapical sensory organ as in fig. 3.

Legs of normal build, III rather longer than I and II; tibiotarsus with three clavate hairs (figs. 4, 5); upper claw with a fine tooth just beyond middle, lower claw with an angular untoothed broad inner lamella. On leg I it has a subapical seta reaching to tip of upper claw (fig. 5).

Furca short, ratio of dentes to mucro=3½:1½; mucro (fig. 6) with plain inner lamella; ratio of mucrodens to hind tibiotarsus=5:5.

Female genital appendages fimbriated.

Clothing of short sparse setae, which are a little longer analwards and on appendages.

Only a single specimen of this distinct species was captured although one or two more were seen. It occurred in the same locality as the previous species at Stellenbosch, Cape Province, 28/9/30.

Type in the South African Museum.

Hitherto the only known species of *Sminthurinus* recorded from Africa were *S. niger* Lubbock, recorded by Wahlgren from Cairo, and *S. stenognathus* described by Börner from the Isle of Fundu, in "Collembola aus Ostafrika, Madagaskar und Südamerika," "Reise in Ostafrika," 1907. This author in the same paper places Schött's *Sminthurus piluliferus* from the Cameroons in this genus. Schött's species, however, has a distinctly annulated fourth antennal joint, and possesses no clavate hairs on the tibiotarsus. Both these characters were used by Börner himself in 1906 ("Das System der Collembola," Mitt. Nat. Mus. Hamburg) for separating his genus *Arrhopalites* from *Sminthurinus*. Schött's *piluliferus* then must be regarded as belonging to the genus *Arrhopalites* of Börner.

The four species of *Sminthurinus* now known from Africa may be distinguished by the following table:—

	<i>niger.</i>	<i>terrestris.</i>	<i>stenognathus.</i>	<i>pallidus.</i>
Size . . .	1.0 mm.	1.5 mm.	0.6 mm.	0.9 mm.
Ratio head diag. to ant. segments.	..	11 : 1½ : 3 : 4 : 7	9½ : 1 : 1½ : 2⅔ : 5⅔	8 : 1 : 1½ : 2½ : 5
Ratio dentes to mucro.	5 : 2½-3	5½ : 2	2¼ : 1	3½ : 1½
Ratio mucro- dens to hind tibiotarsus.	5½ : 5¼	8 : 8	12¼ : 11	5 : 5
Ratio head diag. to an- tennae.	8 : 10½	11 : 15½	7 : 8	8 : 10
Claws . . .	I different from II and III No sheath on upper claw.	I, II, and III alike. Sheath on upper claw.	I different from II and III. No sheath.	I different from II and III. No sheath.
Mucro . . .	Toothed.	Toothed.	Toothed.	Not toothed.
Female appen- dages.	Fimbriated.	Fimbriated.	Simple.	Fimbriated.
Colour . . .	Black.	Black.	Violet.	Yellow.

Sminthurinus pallidus comes nearest to the European *S. aureus* Lubb., but is easily recognised by the compound structure of the wart-like protuberance on ant. III and the simple untoothed mucrones. In the first of these characters it agrees with the species of this genus described from Australia (Results Dr. Mjöberg's Exp. to Australia, 1917) by Schött, in that the protuberance is three-lobed.

Subfam. SMINTHURINAE C.B.

Genus *Rastriopes* C.B.

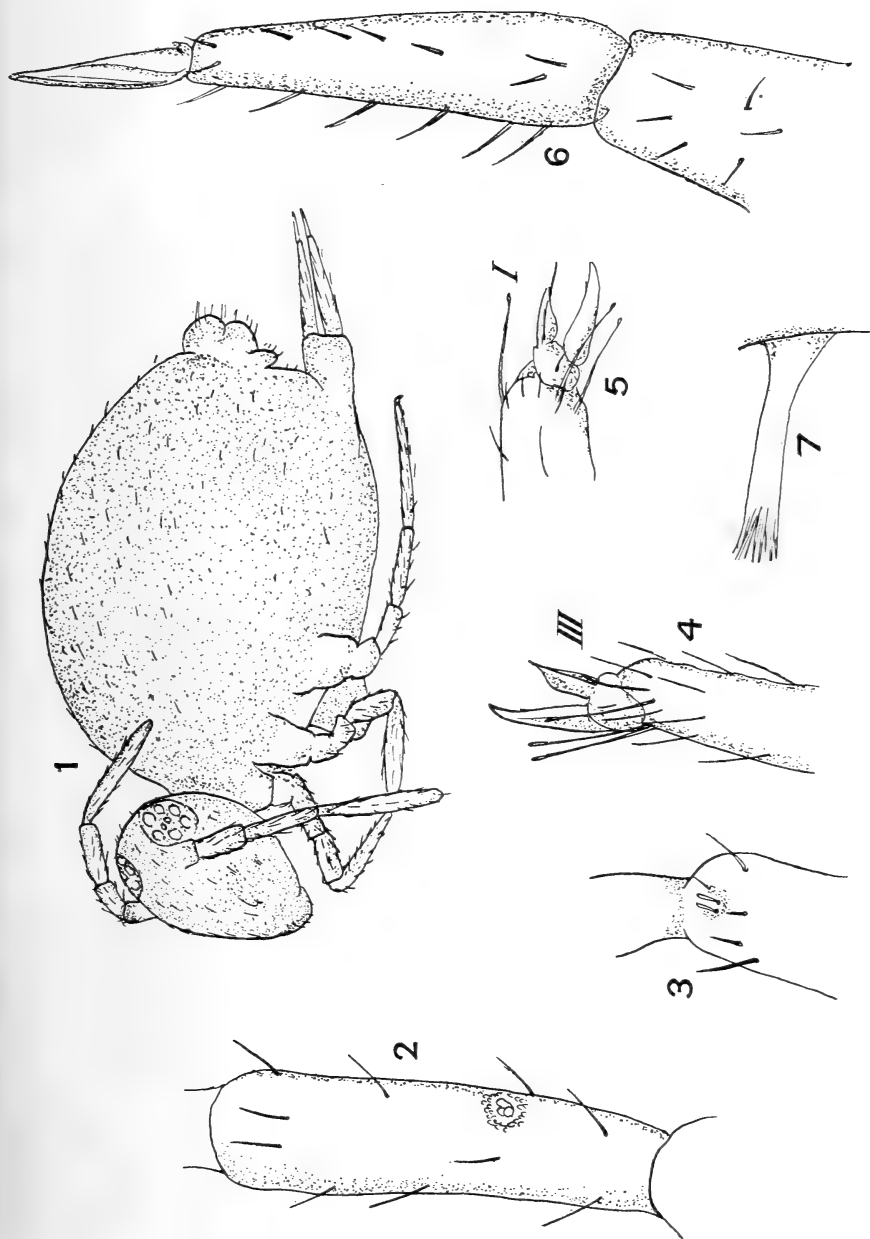
Rastriopes lineata sp. n.

(Plate XI, figs. 1-7.)

Diagnosis : Size 1.6 mm. Colour deep violet-black, especially on the flanks, mid-dorsally is a pale whitish longitudinal line. Antennae violet. Legs and furca, except on basal joints, lighter.

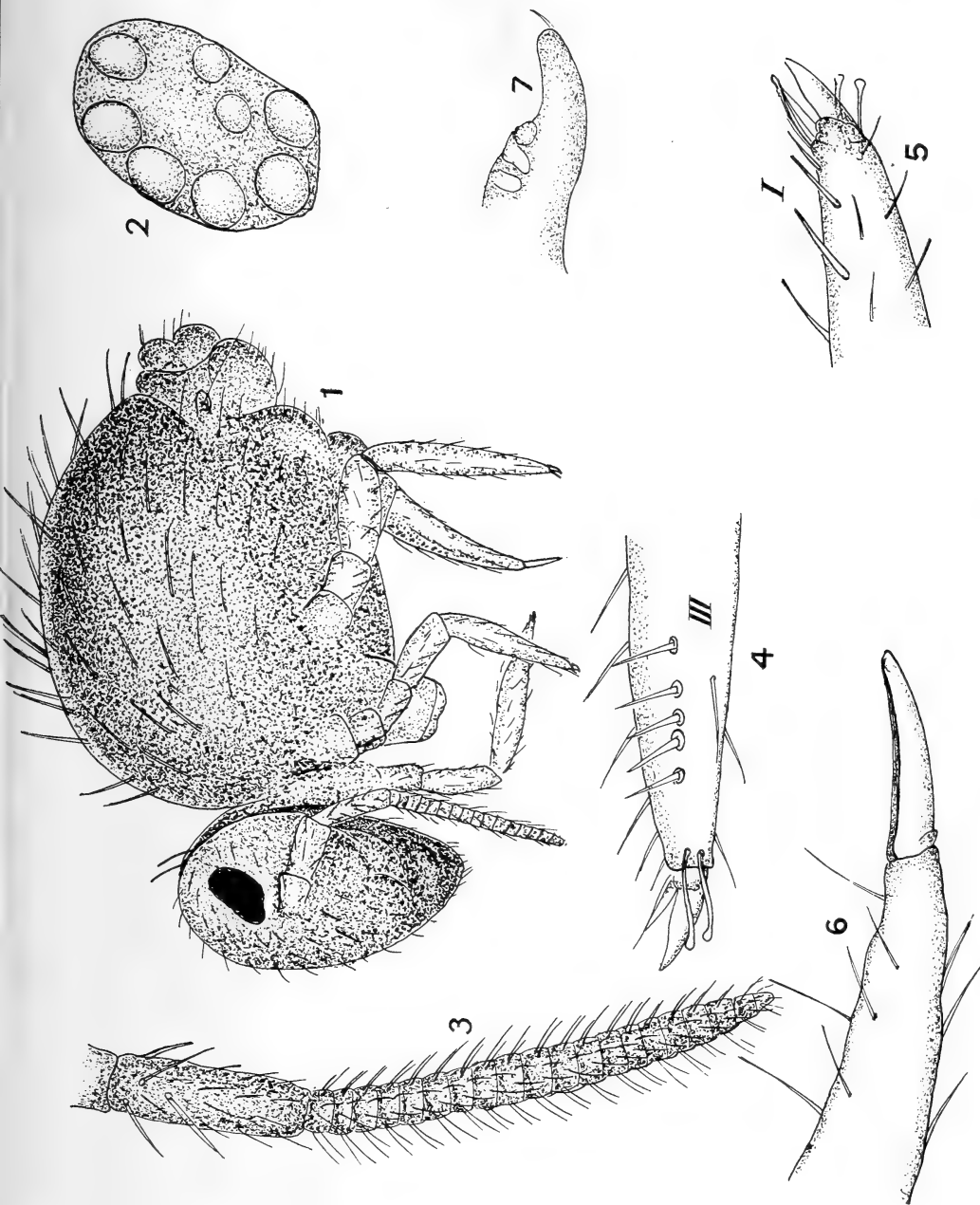
Eyes 8+8 on deep violet patches (fig. 2).

Antennae half as long again as the head, ratio head diag. to antennal joints=11 : 1½ : 3 : 4 : 8; ant. IV strongly subdivided into 17-18 sections, apically with a large extrusible knob in the usual groove; ant. III basally with 4-5 long, strong setae (fig. 3).

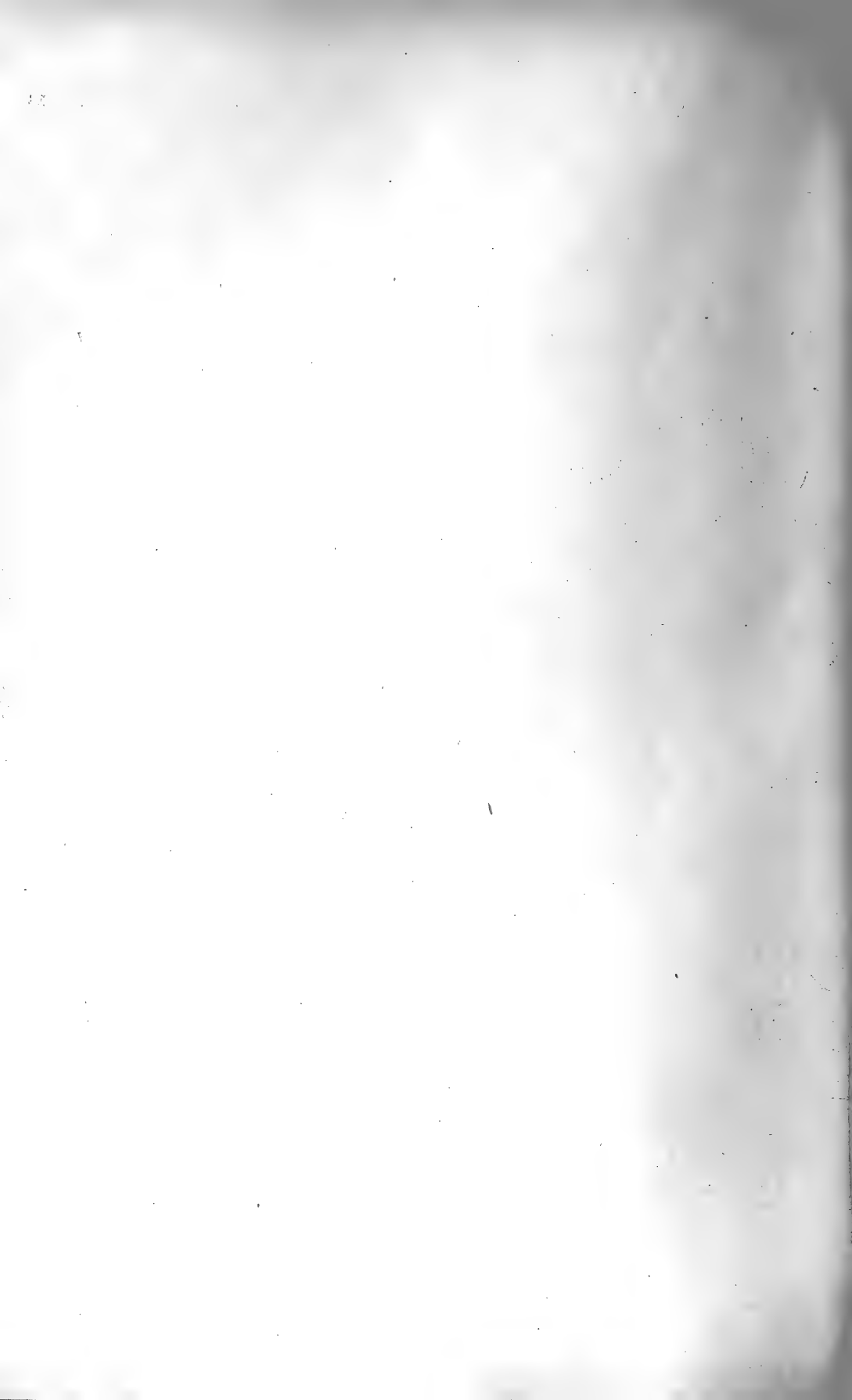


Figs. 1-7.—*Sminthurinus pallidus* sp. n.





Figs. 1-7.—*Rastriopea lineata* sp. n.



Legs normal, claws similar on all feet, upper claw without teeth, lower claw with only a narrow inner lamella. Tibiotarsi with 2 : 3 : 3 strong, broadly clavate hairs; on hind legs on inside besides the usual setae is a special arrangement of five strong spines in a row. This organ corresponds with the "Rastraldornen" of Börner on the presence of which he erected this genus. The spines in our species are, however, distinctly not serrated.

Furca fairly long, reaching to ventral tube, ratio dentes : mucro = $5\frac{1}{2} : 1\frac{3}{4}$; mucro without teeth.

Female genital appendages wanting?

Clothing of short sparse setae.

Type, a solitary specimen in the South African Museum.

Locality.—Under a fallen twig, Kloof Nek, Cape Town, 27/7/30. I have also seen four immature specimens of this interesting form, together with a large number of a small *Hypogastrura* collected by Dr. K. H. Barnard from the surface of rain pools at Cape Town, 9/5/16.

In spite of the simple structure of the "Rastraldornen," this species appears definitely to belong to Börner's genus. The only other species of *Rastriopes* from Africa is *amphygia* described by Börner from South-West Madagascar. In this form the spines comprising the "Rastral" organ are six in number, and apically toothed.

Genus *Deuterosminthurus* C.B.

Deuterosminthurus marmoratus sp. n.

(Plate XII, figs. 1-7.)

Diagnosis: Size 3.0 mm. Colour black and white mottled (fig. 1), tip of tibiotarsi, dentes, and ant. IV lighter.

Eyes 8+8 on black patches. Antennae one-third as long as head, ratio head diag. to antennal joints = $4\frac{1}{2} : 1 : 1\frac{1}{2} : 1\frac{1}{2} : 3$; ant. IV subdivided into 14 sections; ant. III basally divided giving the appearance of a fifth joint; ant. IV with an apical knob lying in a deep groove.

Legs normal. Claws short and broad without inner teeth, lower claw with only very narrow inner lamellae and with subapical setae, longest on III, reaching past tip of upper claw (figs. 3, 4). Tibiotarsi with 3 : 3 : 2, strong, broadly clavate hairs (figs. 3, 4). Setae on inner side of tibiotarsi are strong and conspicuous, but irregularly arranged and not as in *Rastriopes*.

Furca: ratio dentes to mucro = 3 : 1; dentes slightly annulated dorsally; mucro without teeth on edges of inner lamellae.

Anal appendages of female strong, and at tip broadly lobate.

Co-types in the South African Museum.

The description of this species is based on four specimens in the collection of the South African Museum, which were collected by Dr. Barnard from rain pools at 4000 ft. in the Hottentots Holland Mountains, January 1916, and on top of Kalk Bay Mountain, Cape Peninsula, 12/1/12. Other specimens taken in the same localities, but amongst grass, were rather smaller, greenish, and with no mottling, but did not differ morphologically. This variety I propose to name after my friend Dr. Barnard. In spirit the mid-dorsal line is dark, and there is a purplish pigmented spot on the anal segments and a slight streak of the same colour on the flanks of abd. IV.

Subfam. DICYRTOMINAE C.B.

Genus *Dicyrtomina* C.B.

Dicyrtomina minuta O. Fab. form *africana* nov.

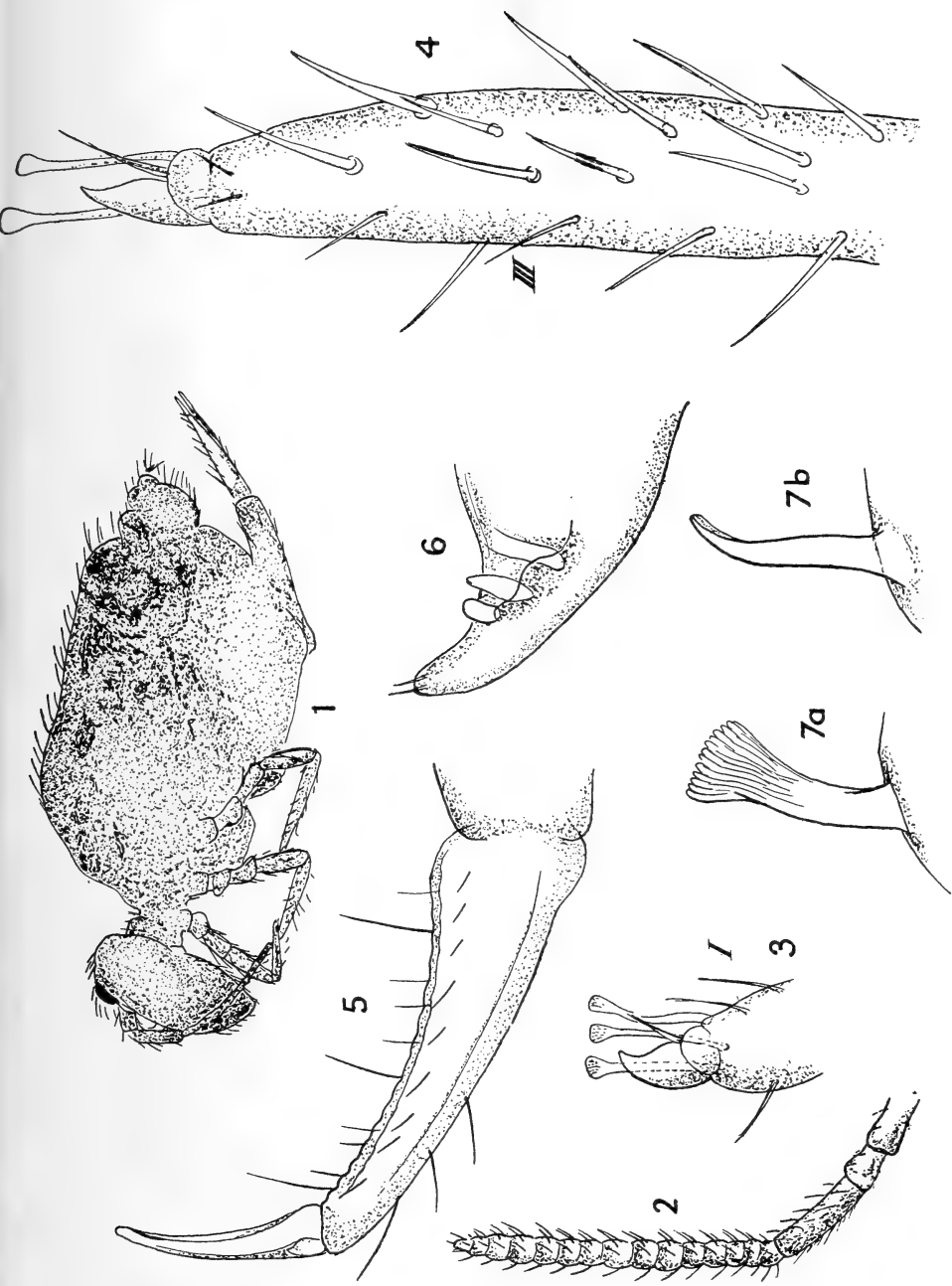
(Plate XIII, figs. 1-4.)

This seems to be a distinct form of this well-known European species, only differing in colour and very slight and unimportant variations in morphological details.

It is somewhat larger than the English forms. Its colour is generally greenish black, and mottled much as in the form *ornata* Lubb. The antennae are deeply pigmented except IV, which is almost colourless, as are the legs and furca.

Locality.—On native olive bushes, Elsenburg, 24/7/30, and also Elsenburg, 28/8/27 (coll. Dr. Hesse).

The type form of this species as well as its variety, *couloni* Nic., has been recorded by Dr. Handschin from Algeria (Zeitsch. f. wiss. Insektenbiol., Bd. III, 1926).

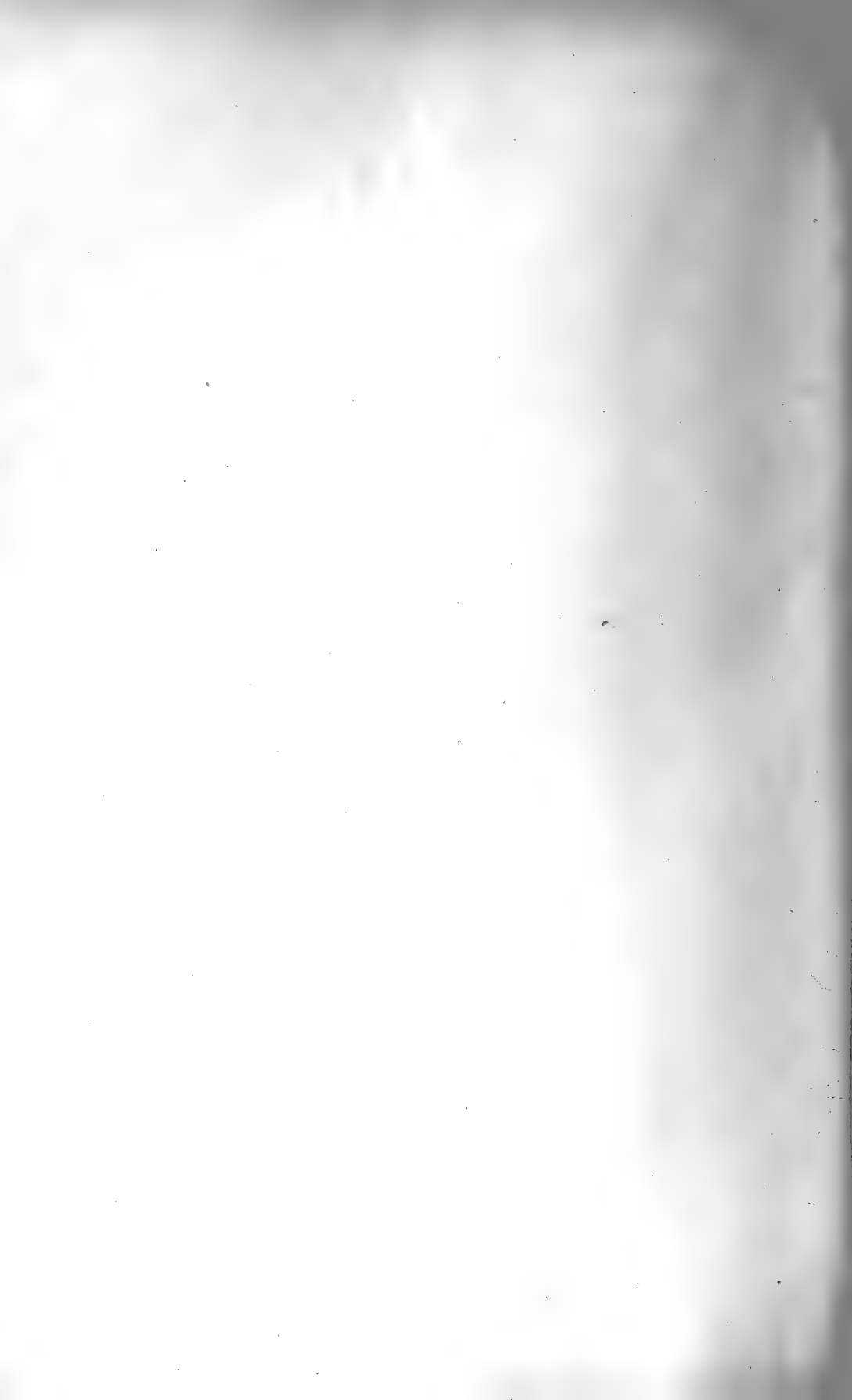


FIGS. 1-7.—*Deuterosminthurus marmoratus* sp. n.





FIGS. 1-4.—*Dicyrtomina minuta* O. Fab. form *africana* n.



EXPLANATION OF PLATES.

PLATE VIII.

Sminthurinus niger Lubb.

1. Side view of animal.
2. Protuberance on ant. III.
3. Hind foot.
4. Fore foot.
5. Dentes and mucro from side.
6. Female genital appendage.

PLATE IX.

Sminthurinus terrestris sp. n.

1. Side view of animal.
2. Hind foot.
3. Front foot.
4. Dentes and mucro from side.
5. Female genital appendage.

PLATE X.

Sminthurinus pallidus sp. n.

1. Side view of animal.
2. Third antennal segment, showing protuberance.
3. Subapical sensory organ on ant. III.
4. Hind foot.
5. Front foot.
6. Dentes and mucro from side.
7. Female anal appendage.

PLATE XI.

Rastriopes lineata sp. n.

1. Animal from side.
2. Eye patch.
3. Ant. III and IV.
4. Hind foot and tibiotarsus.
5. Front foot.
6. Dentes and mucro from side.
7. Catch.

PLATE XII.

Deuterosminthurus marmoratus sp. n.

1. Animal from side.
2. Antennae.
3. Front foot.
4. Hind foot and tibiotarsus.
5. Furca from side.
6. Catch.
7. Female anal appendage—7*a*, from above ; 7*b*, from side.

PLATE XIII.

Dicyrtomina minuta O. Fab. form *africana* n.

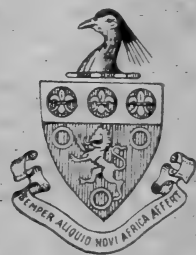
1. Animal from side.
2. Apex of ant. III and whole of ant. IV.
3. Hind foot.
4. Mucro and apex of dentes.

ANNALS
OF THE
SOUTH AFRICAN MUSEUM

VOLUME XXX

PART II, containing:—

9. *Reports on the Marine Mollusca in the Collections of the South African Museum.* VI-VIII. By J. R. LE B. TOMLIN, M.A. (With 10 Text-figures.)
10. *Some South African Machilidae (Thysanura).* By H. WOMERSLEY, A.L.S., F.E.S., Entomologist, Australian Council for Scientific and Industrial Research. (Published by permission of the C.S.I.R.) (With 3 Text-figures.)
11. *Contributions to the Crustacean Fauna of South Africa.* No. 11. *Terrestrial Isopoda.* By K. H. BARNARD, D.Sc., F.L.S., Assistant Director. (With 80 Text-figures.)



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9. *Reports on the Marine Mollusca in the Collections of the South African Museum.* VI-VIII.—By J. R. LE B. TOMLIN, M.A.

(With 10 Text-figures.)

VI. FAMILY FASCIOLARIIDAE.

I HAVE seen very few examples of the genus *Fasciolaria* from South Africa. Sowerby is responsible for the solitary record of the common Indo-Pacific *F. filamentosa* Lam. from Durban, and that of *F. trapezium* L. from Natal.

F. badia Krauss is a synonym of Reeve's *lugubris*, described in the previous year. Of *F. heynemanni* Dunker much more material is required to determine its variability.

Attention may be called to two species described by Strebel in Mitteil. aus dem Naturh. Museum, xxviii, pp. 31 and 33 (Jahrb. Hamburg. Wiss. Anstalt., xxviii): one called *F. dunkeri* from Elim is a very young shell which will probably prove eventually to be the young of some larger, known species; the other, *F. scholvieni*, is a fine shell, over 6 inches in length and $2\frac{1}{2}$ inches in breadth, labelled "Cape." Both are in the Scholvien collection.

The South African Museum has a fine, dead shell even larger than this, though it has lost 2 or 3 of the apical whorls, dredged on the Agulhas Bank.

This is a perfectly distinct species from *F. scholvieni*, and I propose to call it

Fasciolaria agulhasensis n. sp.

It is a large solid shell, with traces of a brownish periostracum, 8 (remaining) whorls, columella much arched, and a long canal some 7 mm. broad.

The whorls are regularly sculptured with spiral ridges which vary a good deal in breadth and strength; as a rule the stronger and weaker spirals are alternate, but at times two weaker ones come together; there is a particularly strong peripheral ridge on the body-whorl, and an equally strong one 7 mm. above, which becomes an obtuse central keel on the upper whorls.

Aperture elliptical in shape.

Long. $7\frac{1}{8}$ inches; diam. max. $3\frac{3}{16}$ inches.

VOL. XXX, PART 2.

11

Hab. Agulhas Bank, 28 fathoms (S.A. Mus., No. A6539).

The canal is not quite perfect, and is somewhat bent to the right abnormally, owing to an injury.

It differs from *F. scholvi* especially in the shape of the aperture and in the character of the spiral sculpture. In general appearance it is not unlike some specimens of *Hemifusus morio* (L.), but that

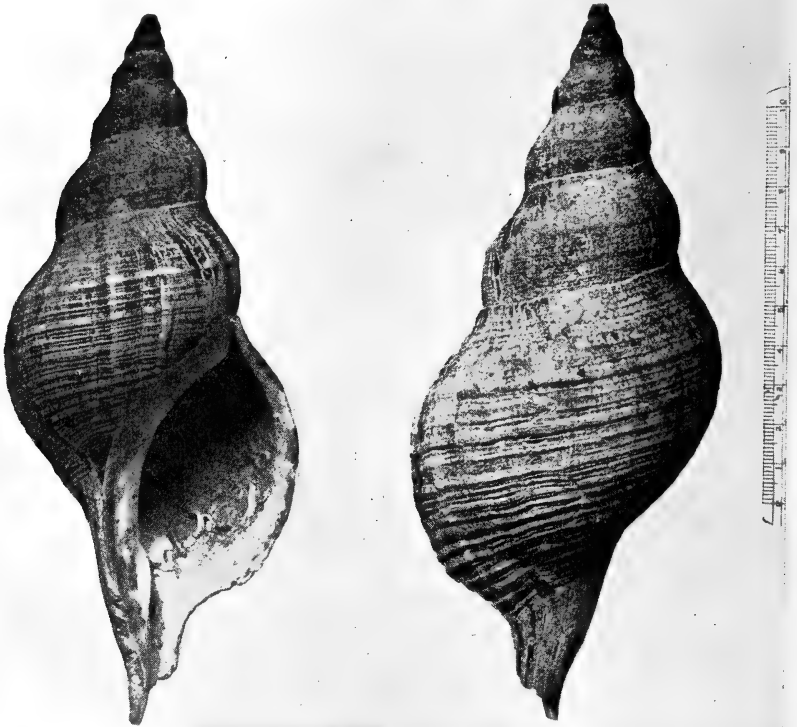


FIG. 1.—*Fasciolaria agulhasensis* n. sp.

shell, of course, has not the columellar plaits that distinguish a *Fasciolaria*.

Latirus mosselensis n. sp.

Shell turreted, fusiform, rimate, with spire produced; whorls eleven in number, acutely nodulous a little below the middle of each whorl, with an additional row of much weaker nodules below the periphery of the body-whorl; canal long and quite straight; colour of periostracum brownish terracotta, columella and interior bright

pinkish ; columella quite straight, with two plaits obscure and only just traceable ; the length of aperture and canal is almost exactly half the total length.

Long. 53.5 mm. ; diam. max. 23 mm.

Hab. off Mossel Bay, 27 fathoms, two live specimens (S.A. Mus., No. A3504).

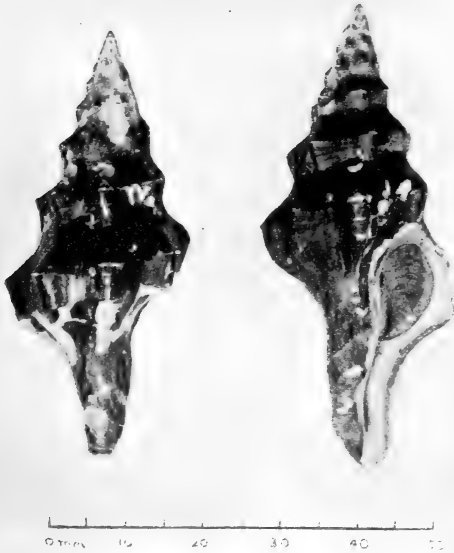


FIG. 2.—*Latirus mosselensis* n. sp. Type on left, paratype on right.

This fine species has somewhat the build of *L. armatus* A. Ad., but is much larger with a longer canal ; the surface is noticeably smooth but for the nodules, which are below the periphery of each whorl instead of above as in *armatus*.

The operculum is typically Fasciolariid, pear-shaped, pointed at the apex with apical nucleus ; colour light-brown ; narrowly concave on the columellar side ; growth-lines very numerous and regularly semicircular.

VII. FAMILY FISSURELLIDAE.

A very considerable number of species has been described or recorded, under the generic heading of "Fissurella," from the Cape.

Most of these belong to the genus *Diodora* Gray, of which the

genotype is an English species, *D. apertura* (Montagu)—a shell of very much the same appearance as *D. australis* (Krauss).

The list includes several doubtful names, and has been materially increased by misidentifications.

One species, *Fissurella robusta* Sowerby, described from Port Elizabeth on a single imperfect specimen, has all the appearance of a fossil, and should, I think, be omitted from the list of recent species.

F. conioides (Reeve) was erroneously described as a Cape species : it is endemic in the Cape Verde Isles.

Gmelin's *Patella caffra* is a *Fissurella*, but unlike any South African species, though assigned by its author to the Cape of Good Hope. It has never been certainly identified, and is omitted from the Manual of Conchology, vol. xii. The figure on which it is based looks like one of the true *Fissurellas* from South America, especially as it is said to have a dark border inside.

D. fumata (Reeve) is another name which we may reject. It was described from an unknown locality, but is identical with the Caribbean *alternata* Say. The South African records were doubtless based on shells of *elevata* Philippi. It seems rather unwise of Boog Watson, in the Challenger Report, p. 34, to have assigned his unidentifiable, broken shell from Sea Point to any definite specific name, even with a query.

D. cruciata (Krauss) is preoccupied by a species of Gould's from the East, and has been renamed *crucifera* Pilsbry. I have seen examples of this in the collection of the S.A. Museum from Tongaat, Natal.

D. australis (Krauss). The S.A. Museum has this from Port Elizabeth and Delagoa Bay.

Gen. FISSURIDEA Swainson.

The type of this group, *F. galeata* (Helbling), is the only species given in Tryon's Manual. It is characterised by a very small perforation which opens forward rather than upward, while the apex of the shell leans forward and tends to overhang the anterior margin. It is a species of the Far East.

Fissurella parviforata Sowerby* is evidently closely related to *galeata* Helbling, while it has the foramen still smaller and the apex still further forward. I therefore transfer it to the genus *Fissuridea*.

Bartsch in the Turton Report† placed six species in *Fissuridea*, but I regard the first five as belonging to *Diodora*.

* Journ. of Conch., vi, p. 12, pl. i, fig. 7, 1889.

† U.S. Nat. Mus. Bull. 91, p. 177, 1915.

F. parviforata Sow. was described from Port Elizabeth: the S.A. Museum has it from Mossel Bay and Kalk Bay. I have received it from Ascension Island, and the specimens from St. Helena identified doubtfully by Smith * as *gibberula* Lam. ? belong to *parviforata*.

Gen. *MACHROCHISMA* Swainson.

The single South African species belonging to this genus (which Swainson spelt as above) has usually been assigned to *M. producta* A. Ad., and though Sowerby identified different specimens at various times as *producta* A. Ad. and *compressa* A. Ad., I have but little hesitation in thinking that all belonged to a single form.

I fail to see, however, why it was ever identified with the Australian forms, and proceed to describe it as

Machrochisma africana n. sp.

The shell is rather broadly rectangular, the length being a little more than twice the breadth, and the two ends are almost similarly rounded; the slit is half the total length of the shell, narrowing rather gradually from the margin, which is noticeably depressed and strongly thickened at the broad end of the slit; in colour it is rather vaguely blotched and streaked with red on a light ground; the sculpture consists of fine, regular ridges radiating downwards from the slit to the margin all round, with somewhat irregular concentric growth-lines which produce beading where they cross the ridges.

Long. 22 mm.; diam. max. 10 mm.

Hab. Port Alfred (Becker).

A young shell from the same locality measures 10×4.5 , thus maintaining practically the same proportions.

The S.A. Museum has specimens from Scottburgh (Burnup). It

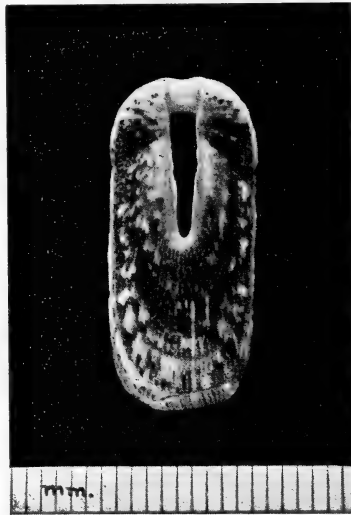


FIG. 3.—*Machrochisma africana* n. sp.

* P.Z.S. Lond., 1890, p. 295.

is also reported from Port Elizabeth, from Umvoti, and from Pondoland.

M. producta A. Ad. differs from *M. africana* by its more acutely saddle-shaped form and by its very different shape; thus a typical South Australian example measures 25×8 , and another 24×8 .

Gen. EMARGINULA Lamarck.

The first and only record of this genus from South Africa will be found in Ann. Natal Museum, vol. ii, pt. ii, p. 209, where Smith records from Tongaat *E. micans* A. Adams, which was originally described from Rains Island. I have not seen this Tongaat shell, but from the explanations necessary to fit it into *micans* one is very much tempted to suspect that it will eventually prove distinct.

The following fine deep-water species is not a perfect shell, but the sculpture is so very clear, fresh, and perfect that there can be no difficulty in recognising it again with the aid of the excellent photograph now given.

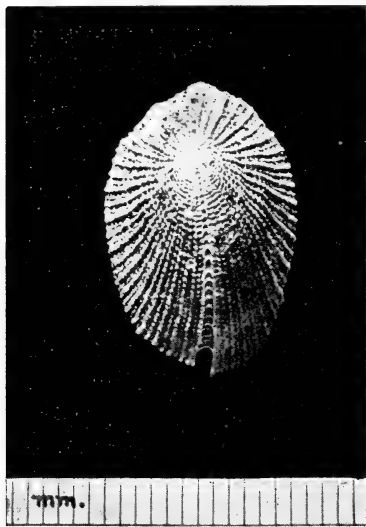


FIG. 4.—*Emarginula pulchreclathrata*
n. sp.

Emarginula pulchreclathrata n. sp.

A fine species, somewhat similar in size and form to *E. sicula* Gray from the Mediterranean and to *E. superba* Hedley from Tasmania, but differing from both in sculpture. The South African shell has a series of alternately stronger and weaker ridges radiating from apex to margin, crossed nodosely by concentric threads; both stronger and weaker ridges vary somewhat in degree, and as a rule the weaker ones first appear some little distance below the apex; the whole

arrangement constitutes a very marked and beautiful piece of lattice-work.

The apex is bent over to form a small hooked beak.

Long. 19 mm.; lat. 12.5 mm.

Hab. off Saldanha Bay in 55 fathoms (S.A. Mus., No. A3617).

Gen. PARMAPHORELLA Strebel.

In 1907 Strebel * described an Antarctic shell as *Tugalia antarctica*, and mentioned that it had long been in the Hamburg Museum with the MS. name of *Parmaphorella antarctica*, given by Pfeffer. While recognising that there was a good deal to be said for Pfeffer's suggestion of making it the type of a new genus, Strebel eventually decided to class the shell in *Tugalia*, owing to its very worn and weathered condition.

In 1907 also, but later than Strebel, Melvill and Standen † likewise described a *Tugalia antarctica* from the collections of the Scottish National Antarctic Expedition. This was a shell of very similar character to Strebel's *antarctica*, though specifically distinct. It was renamed *T. melvilli* by Thiele in 1912.‡

I do not think that there can be any doubt that these two forms, together with a third which is obviously congeneric and now to be described, constitute a genus distinct from *Tugalia*, and that Pfeffer was right in his suggestion.

Strebel only mentions the existence of this label to reject it as far as the generic part is concerned, but I suppose that this constitutes publication, however paradoxical the situation, and that *Parmaphorella* must be credited to Strebel, the genotype being *Tugalia antarctica* Strebel.

The shell of *Parmaphorella* has all the facies of a deep-water mollusc in its thinness and coloration; it is much more convex than *Tugalia* and has the apex prolonged into a regular hooked beak, hollow within, which almost overhangs the margin.

There is a rather ill-defined anal notch from which a shallow, well-marked groove within runs right up to the apex, with an enlarged, conspicuous, external rib corresponding to the groove. The posterior margin is moderately flattened out into a sort of flange, rather in the manner of the genus *Plesiothyreus* Cossmann, though to a less degree. The sculpture of *Parmaphorella* is much finer than that of *Tugalia*, and variously differentiated on the external anal rib; thus in *P. melvilli* (Thiele) the original figure, cited above, correctly shows this rib at least twice the breadth of the others and regularly crossed by the concentric striae. In *Tugalia* there is no alteration of sculpture to mark the anal rib.

* Zool. Jahrb., xxv, p. 105, pl. ii, fig. 26, a-e, 29/8/1907.

† Trans. Roy. Soc. Edin., xlvi, p. 128, fig. 1, 21/12/1907.

‡ Deutsche Südpolar Exp., xiii, p. 197, pl. xii, fig. 6.

Parmaphorella barnardi n. sp.

Shell thin, white, convex, oblong; apex at the posterior end produced in the form of a hollow beak very nearly to the posterior margin, which is somewhat splayed out to form a sort of flange; anterior margin distinctly grooved, the groove running within right up to the apex, and marked outside by a corresponding, outstanding rib, broad at the base and narrowing by degrees to quite a sharp keel on the apex; surface cancellated throughout, the concentric striae being the stronger, except at the posterior end, and rather rough and irregular.



FIG. 5.—*Parmaphorella barnardi* n. sp.

Long. 19 mm.; diam. max. 12 mm.

Hab. Cape Point, N. 50° E., 18 miles, 180 fathoms, a dead shell (S.A. Mus., No. A3623).

Another specimen from same locality, with apex broken, measures 21 × 15 mm.

Named in honour of Dr. K. H. Barnard, the Assistant Director of the South African Museum.

VIII. FAMILY BUCCINIDAE.

Gen. GLYPTEUTHRIA Strebel.

Until 1905 the genus *Euthria* Gray included a small but rather varied assemblage of species mainly from the Magellanic province and from New Zealand, with stragglers up the Pacific coast of America right away to Japan. It has as its type the well-known Mediterranean *Murex corneus* of Linné, a solid, nearly smooth shell with the upper part of each whorl much appressed, the canal long and recurved, while the operculum is oval with apical nucleus.

Strebel * distributed his Magellanic material into 3 new subgenera, *Pareuthria*, *Glypteuthria*, and *Anomacme*, and it may be well here to fix *E. meridionalis* Smith as the type of *Glypteuthria*, and *Fusus plumbeus* Philippi as the type of *Pareuthria*. The third subgenus is monotypical. All the species assigned to these three groups agree in having a very short, incipient canal and a normal Euthriid operculum.

* Zool. Jahrb. (Syst.), xxii, pp. 600, 627, 633.

I have no hesitation in following Thiele * in raising *Glypteuthria* to generic rank.

It contains a homogeneous group of species which are characterised by their more obvious sculpture, in which axial ribs and spiral cords play a fairly equal part ; this sculpture begins early, though according to Strebel the protoconch is smooth. In all the examples before me the apex is badly worn.

The South African Museum has dredged two forms in deep water that I regard as belonging to this genus, and they are described below.

Glypteuthria capensis n. sp.

Shell elongate, solid, of a dirty white colour, seven-whorled ; sculpture consisting of numerous regular, curved, axial ribs, about sixteen

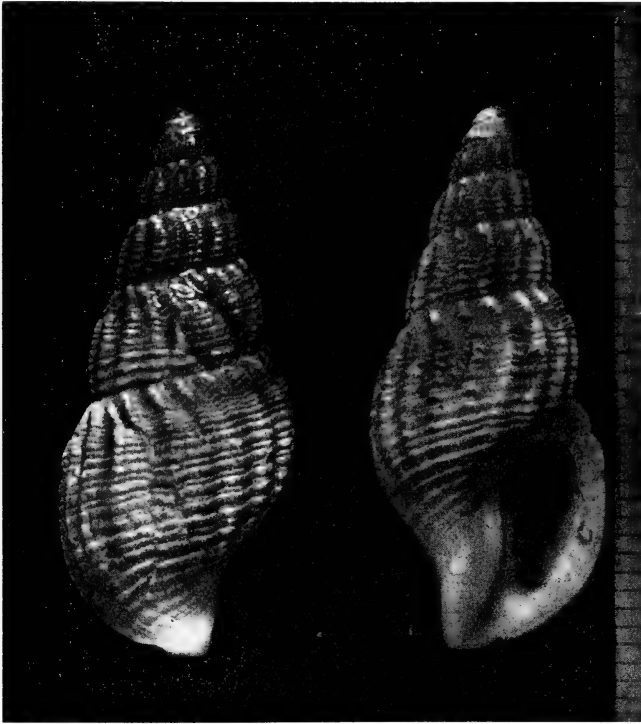


FIG. 6.—*Glypteuthria capensis* n. sp.

in number on the body-whorl, and of close spiral cords which vary a good deal in degree and are noticeably finer immediately below the

* Handb. Syst. Weichtierkunde, pt. i, p. 318, 1929.

suture ; aperture elongate, more than twice as long as broad ; canal broad and short, very slightly recurved ; columella deeply excavate ; operculum that of a normal *Euthria*.

Long. 29 mm. ; diam. max. 12 mm.

Aperture, 12×5.5 mm.

Hab. Cape Point, N. 41° E., 38 miles, 318–400 fathoms (S.A. Mus., No. A3446), several living examples.

Glypteuthria solidissima n. sp.

Shell elongate, very strong and solid, greyish white ; whorls convex, seven (?) in number (the apex being decollate) ; sculpture consisting of numerous straight axial ribs which only reach the upper part of the body-whorl above the periphery—on the penultimate



FIG. 7.—*Glypteuthria solidissima* n. sp.

whorl there are about 18, and of fairly close spiral cords alternating with a varying number of finer threads ; there are about 12 of these cords on the body-whorl, and the 4 or 5 uppermost ones are irregularly interrupted by the axial ribs ; suture impressed ; columella deeply excavate ; canal rather long and recurved ; aperture long oval, denticulate within.

Long. 27 mm. ; diam. max. 12.5 mm.

Aperture, 8×4 mm.

Hab. off Cape Point, 11 miles, in 45 fathoms, one example (S.A. Mus., No. A3543).

This differs from *G. capensis* in sculpture, in the form of the canal, and in the convexity of the whorls.

In addition to the above the South African Museum has three species, all new, which do not seem referable to any established genus or section. These three constitute a homogeneous little group of nearly related forms, which I feel sure ought to be placed in proximity to *Euthria* and its allies, though unluckily the soft parts and operculum are missing in every specimen.

All three are abyssal; in the case of one species exact data are lacking, but it has the unmistakable facies of a deep-water shell, and is known to have occurred, like the other two, in the dredgings of the "Pieter Faure."

The three species are of an extremely graceful attenuate form, reminding one not a little of the palaeartic species of *Colus* Röding (*Sipho* auct.); the shells are finely and closely spirally grooved, white, covered with a very thin, delicate, shiny periostracum which is slightly cream-tinted; canal broad and short; aperture rather less than half the length of the shell.

For this little group I propose the genus *Charitodoron* * as a new group of the Buccinidae, and name the three species after Hesiod's version of the names of the three Graces—Euphrosyne, Aglaia, and Thalia.

The genotype is *C. euphrosyne*, which I proceed to describe.

Charitodoron euphrosyne gen. et sp. nov.

Shell gracefully elongate, spindle-shaped, white with very pale yellowish periostracum, marked longitudinally with numerous inconspicuous, irregularly spaced ribs; whorls 7, regularly spirally lirate with shallow punctate striae, there being 9 striae on the penultimate and on the antepenultimate whorl; below the periphery of the last whorl are numerous furrows, much deeper and broader than those on the rest of the shell; canal broad and very short; aperture elongate oval.

Long. 27 mm.; diam. max. 9 mm.

Aperture: long. 11 mm.; lat. 4.5 mm.

* "Gift of the Graces."

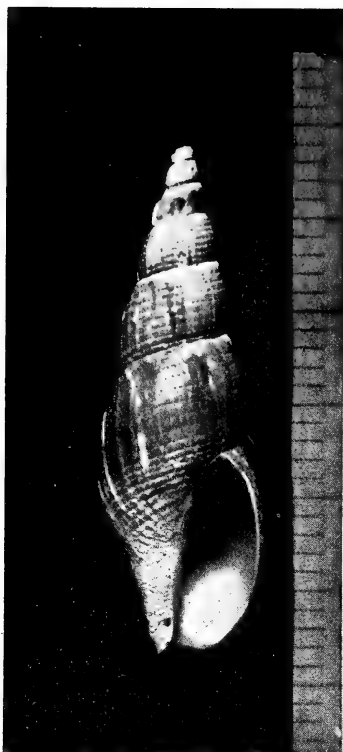


FIG. 8.—*Charitodoron euphrosyne*
n.g., n. sp.

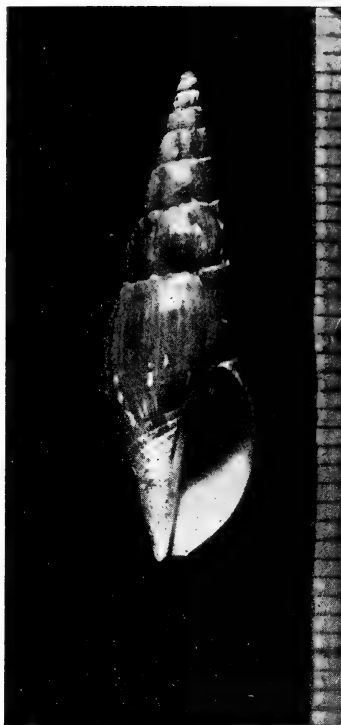


FIG. 9.—*Charitodoron aglaia* n. sp.

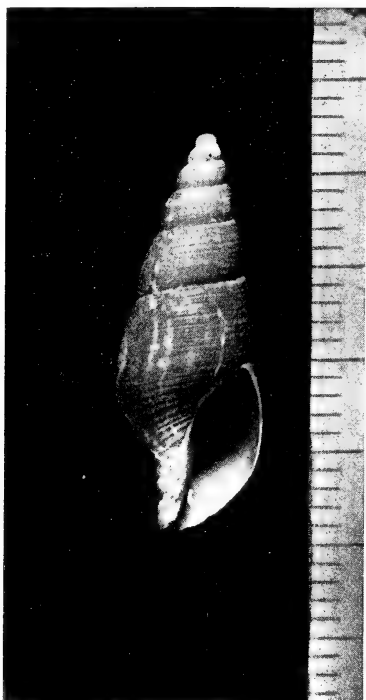


FIG. 10.—*Charitodoron thalia* n. sp.

Hab. off Cape Point in 660-700 fathoms, two examples (S.A. Mus., No. A3441).

At least one whorl is missing in both examples of this species.

Charitodoron aglaia n. sp.

Bears considerable resemblance to the last species, but has 9 whorls, is obviously more slender, and has a more decidedly yellowish periostracum, which is thicker, and on the last 4 whorls makes the spiral striae all but indiscernible; on the earlier whorls the striae are evident, strong, and punctate; the longitudinal ribs or growth-lines are weaker and much more inconspicuous than those in *euphrosyne*; the body-whorl is furrowed only on the lower half of the infra-peripheral area.

Long. 26 mm.; diam. max. 8 mm.

Aperture: long 11 mm.; lat. 3.5 mm.

Hab. South Africa, two examples (S.A. Mus., No. A3440).

Details as to the habitat of this species are unfortunately lacking.

Charitodoron thalia n. sp.

The third species differs materially from the two already described; in form it is quite reminiscent of the palaearctic *Colus propinquus* (Alder). It has 8 whorls, but is not so elongate as the other two and increases more rapidly in diameter; the longitudinals are very fine, numerous, and strongly arcuate; the spiral lirae are more obvious through the periostracum, stronger throughout, and not punctate—11 or 12 in number on each whorl; the body-whorl is regularly lirate throughout, the lirae becoming broader and coarser below the periphery; canal slightly narrower and longer; aperture much as in *C. aglaia*.

Long. 21 mm.; diam. max. 8 mm.

Aperture: long. 9 mm.; lat. 3 mm.

Hab. off Cape Point in 131 fathoms, one example (S.A. Mus., No. A1742).

I ought to say that the Museum is very much indebted to Mr. A. E. Salisbury for almost all the photographs here used.

10. *Some South African Machilidae (Thysanura)*.—By H. WOMERSLEY, A.L.S., F.E.S., Entomologist, Australian Council for Scientific and Industrial Research. (Published by permission of the C.S.I.R.)

(With 3 Text-figures.)

THE members of the family of Bristle-tails treated of in this paper comprised five species belonging to three genera. All the genera can be placed in the subfamily *Meinertellinae* Carpenter, as distinguished by the abdominal sternites possessing very small triangular medial parts and in no segment having more than a single pair of exsertile vesicles.

The specimens consisted of a number collected by myself while in Cape Town district during August and September 1930, on behalf of the Entomological Division of the Australian Council for Scientific and Industrial Research.

In addition to my own captures I have been privileged to examine a number of specimens in the collections of the South African Museum. For this, I am indebted to Dr. L. Gill, Director, and Dr. K. H. Barnard, Assistant Director. To these gentlemen I offer my warmest thanks.

Specimens of those species collected by myself will be deposited in the Museum of the Division of Entomology, Canberra, Australia, and also in the South African Museum, Cape Town.

ORDER THYSANURA Lubb.

FAMILY MACHILIDAE Grassi.

Gen. MACHILIODES Silv.

Machiloides malagassus Silv.

This species was originally described by my friend Professor Silvestri from Madagascar, from the female sex only (Nuovi Generi e Specie di Machilidae, Redia, ii, 1904). Later he redescribed it from both sexes, from British East Africa (Sjöstedt's Kilimandjaro-Meru Exped., xviii (2), p. 13, pl. 3, figs. 17-27, 1908 [vol. iii, 1910]).

In Cape Colony, it appears to be the commonest species, and can be found almost anywhere under the stones on the mountain slopes.

My captures are dated as follows :—

Slopes of Table Mountain, Kirstenbosch,	2/8/30.
„ „ „ Cape Town,	10/8/30.
„ „ „ „	10/8/30.
„ „ „ „	27/8/30.
„ Lion's Head, „	14/8/30.

In the Museum collection this species is represented by specimens from

Gt. Winterhoek Mt., Tullbagh, C.P.,	Nov. 1916	} Coll. K. H. B.
Keeromberg, Worcester, C.P.,	Sept. 1930	
Forebay, near Mossel Bay, C.P.,	Jan. 1931	
George, C.P.,	Jan. 1931	
Keurbooms River, C.P.,	Jan. 1931	
Pietermaritzburg, Natal,	Nov. 1917	
Krantzkop, Natal,	Nov. 1917	

Machiloides spinipes Silv.

This species, originally described by Silvestri from Natal and Zululand (Tisanuri del Natal, Arkiv f. Zool., Bd. 8, No. 1, p. 14, fig. 11, 1913), was not found in the Cape Province, but in the Museum collection were specimens collected at Pietermaritzburg, Natal, Nov. 1917, by Dr. Barnard.

Machiloides silvestri n. sp.

Description.—Colour (in life) light grey with small dark spots or reflections, giving the insect a very close resemblance to the granite boulders on which it is to be found.

Eyes large, rounded, but slightly narrower than deep, touching medially for about half the depth (fig. 1). Paired ocelli elongate, transverse, inwardly club-shaped, separated by less than a diameter (fig. 1).

Antennae longer than body, basal joint $1\frac{1}{2}$ times as long as broad, cylindrical. Flagellum gradually tapering, distally separating into sections of as many as 15 segments, annulated brown and white.

Maxillary palpi with the segments subapically marked with dark brown pigment, ratio of lengths of joints—male, $1\frac{1}{2} : 3 : 3 : 3\frac{1}{2} : 5 : 5 : 3\frac{1}{2}$; female, $2\frac{1}{2} : 4\frac{1}{2} : 3\frac{1}{2} : 4 : 6\frac{1}{2} : 7 : 4$; joint I with the usual processes in both sexes as in the preceding species, joint II in male with an inner

subapical chitinous hook which is almost straight and simple, in female simple, joint III in both sexes simple, joint IV in male subapically dilated with a bunch of strong scale-like setae (fig. 1).

Labial palpi as in fig. 1.

Thorax only slightly arched. Coxae of legs II and III with normally developed stylets, tibiae not unduly spined.

Abdomen: tergites as in *malagassus* Silv., exsertile vesicles on sternites I to VII.

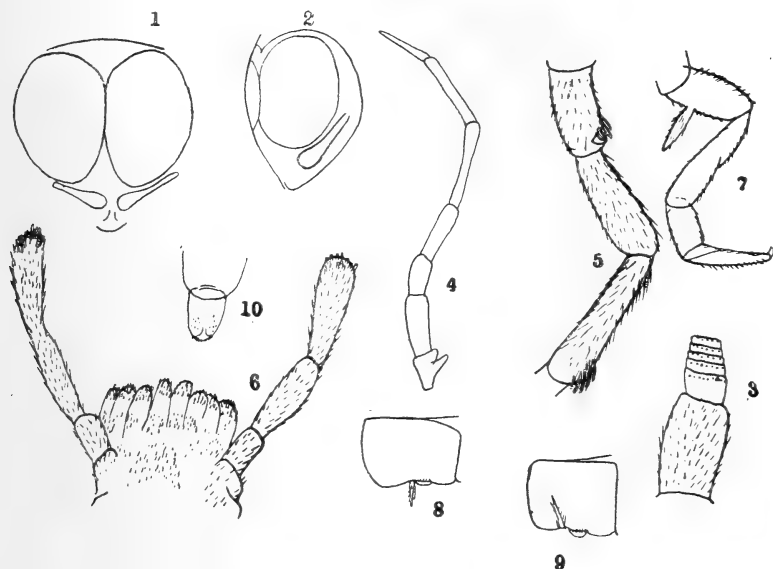


FIG. 1.—*Machiloides silvestri* n. sp.: 1, eyes and paired ocelli, front view; 2, eye and one ocellus from side; 3, basal joints of antennae; 4, maxillary palpi of female; 5, maxillary palpi of male, joints II to IV; 6, labial palpi; 7, leg III; 8, 4th sternite; 9, 7th sternite; 10, penis.

Penis short, gonapophyses absent in male.

Ovipositor long, annulated, reaching tips of lateral cerci.

Lengths: Body 9–10 mm., antennae 13 mm., median cercus 13 mm., lateral cerci 4 mm.

Habitat.—On the surface of granite boulders on the lower slopes of the mountains along the coast.

Localities.—Co-types: Fish Hoek, C.P., 23/8/30; Hout Bay, C.P., 9/8/30; Camps Bay, C.P., 10/8/30; Kloof Nek, C.P., 31/8/30.

This species is intermediate in many respects to the two other South African species of *Machiloides*. In the shape of the eyes it approaches *spinipes*, but the maxillary palpi in the male are more like those of *malagassus*, excepting the presence of the setae on the

fourth joint. In habitat as well as in colour it is markedly distinct from the latter.

As already stated, the genus *Machiloides* was erected by Silvestri in 1904, when he quoted *Machilis appendiculata* Silv. as the type, from Chili. *Machilis anceps* Nic., also from Chili, and *malagassus* were later referred to this genus.

In a conspectus of the genera of *Machilidae* (Redia, ii, 1904), he places *Machiloides* as agreeing with *Praemachilis* in having gonapophyses on the 8th and 9th segments of the male. Earlier in the same paper in describing the genus *Machiloides*, he states :

"Male.—Segmenta abdominalia 8 nm. et 9 nm. appendicibus genitalibus duabus subcylindricis aucta."

In the original descriptions of *appendiculata* and *anceps* no mention is made of the presence or absence of these organs, and all species of this genus described since by other authors as well as Professor Silvestri himself do not possess them. This is the case in the new species described in this paper.

If, then, a re-examination of the types of *appendiculata* by Silvestri has revealed the presence of such organs in this particular species, his description of the genus may be explained. If this is so then it would seem to be advisable to subdivide the genus into at least two subgenera on the presence or absence of these organs, keeping *appendiculata* as type of *Machiloides* s.str. and *malagassus* as type of the other part.

Table for the South African Species of Machiloides Silv. (males).

1. Joint II of maxillary palpi simple without any subapical chitinous hook in male sex. Joint III considerably shorter than II, with a prominent fleshy lobe on which are numerous short spines *spinipes* Silv.
 Joint II of maxillary palpi with a subapical chitinous hook, joint III simple and more than half as long as II 2.
2. Eyes deeper than wide. Paired ocelli distinctly constricted medially and definitely separated from lower border of eyes. Light grey species of littoral habitat *silvestri* sp. nov.
- Eyes wider than deep. Paired ocelli with almost parallel sides, only slightly separated from lower border of eyes. Brownish species of more inland habitat *malagassus* Silv.

Gen. HYPOMACHILODES Silv.

Hypomachilodes capensis n. sp.

Description.—Colour (in life) dark brown, showing dark reflections. Eyes of moderate size, each being slightly wider than deep (fig. 2),

touching medially for $\frac{3}{4}$ of their depth. Each eye has three diagonal streaks running upwards and outwards. Paired ocelli (fig. 2) elongate, transverse, strongly clubbed inwards, distance apart less than a diameter. Single ocellus indeterminate.

Antennae slightly shorter than body, strikingly annulated with brown and white, basal joint cylindrical, twice as long as wide (fig. 2), distally the antennal sections contain up to 14 joints, the apical three joints of each section are white.

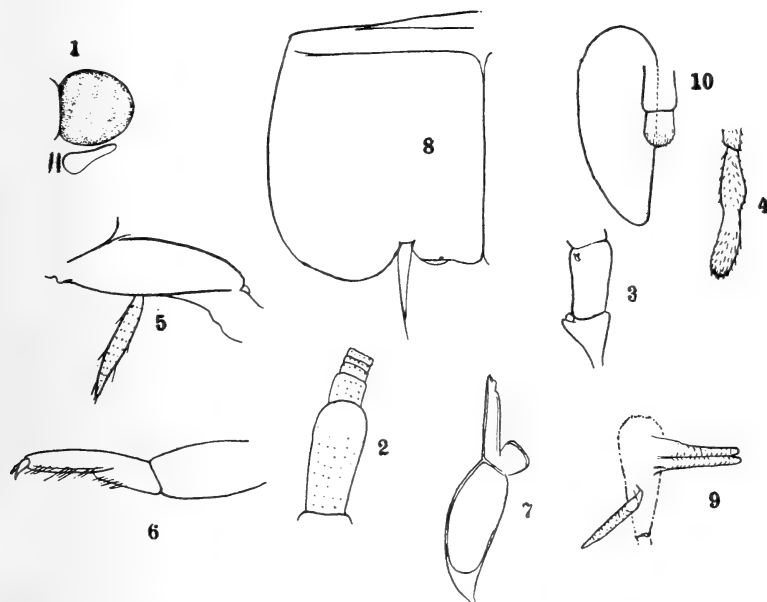


FIG. 2.—*Hypomachilodes capensis* n. sp. : 1, single eye and ocellus ; 2, basal joints of antennae ; 3, joints I and II of maxillary palpi of male ; 4, labial palpi ; 5, leg III, coxa ; 6, leg III, apex ; 7, mandible ; 8, sternite VII ; 9, male gonapophyses ; 10, penis.

Maxillar palpi long, attenuated, ratio of lengths of joints—male, $1\frac{1}{4} : 2 : 1\frac{1}{2} : 1\frac{3}{4} : 3 : 2\frac{1}{2} : 2$; female, $1\frac{1}{2} : 2 : 1\frac{1}{2} : 1\frac{1}{2} : 2\frac{1}{2} : 2\frac{1}{2} : 1\frac{1}{2}$; joint I in both sexes with usual processes, II in male only with an acute short and cruvd chitinous tooth. Labial palpi as in fig. 2. Mandibles as in fig. 2.

Thorax moderately arched. Only coxae of third legs with stylets, which are but little shorter than normal (fig. 2).

Abdomen : Sternites with medial portions scarcely visible, exsertile vesicles present in a single pair on I–VII, stylets on II–IX, stylet IX twice as long as stylet VIII.

Male : Penis short, gonapophyses present on segments VIII and IX, distinctly but finely annulated (fig. 2).

Female : Ovipositor long, annulated, seven times as long as stylet IX.

Lengths : Body 8–9 mm., antennae 6–7 mm., cerci ?.

Habitat.—On fallen twigs in small coppice.

Locality.—Clovelly, Fish Hoek, C.P., 23/8/30. Four specimens.

This genus was erected by Silvestri for a species from Texas, chiefly on the presence of stylets on the coxae of third legs only. In his table referred to above, he gives the absence of male gonapophyses as a generic character. My remarks therefore under the genus *Machiloides* will apply also to this genus.

Gen. MACHILELLUS Silv.

Machilellus delagoensis n. sp.

Description.—Colour (in alcohol, denuded of scales) yellowish white. Eyes rounded, slightly broader than deep, touching medially for

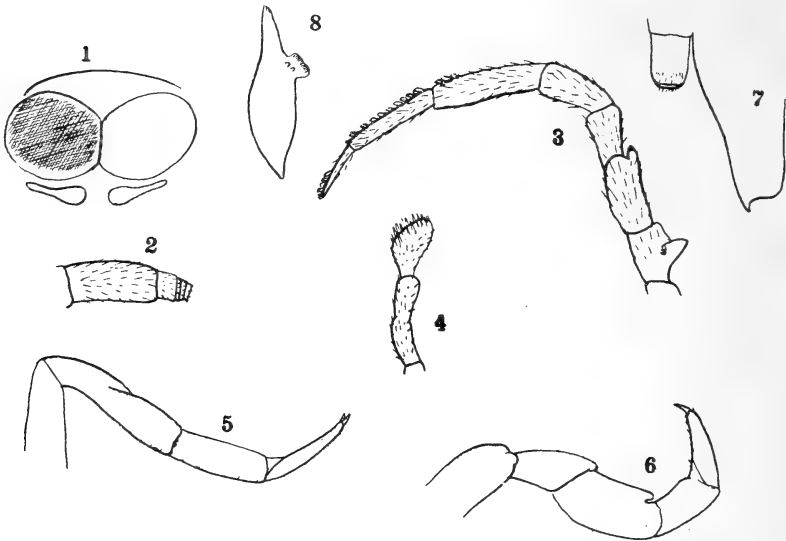


FIG. 3.—*Machilellus delagoensis* n. sp. : 1, eyes and paired ocelli ; 2, basal antennal joints ; 3, male maxillary palpi ; 4, labial palpi ; 5, leg I ; 6, leg III ; 7, penis ; 8, mandible.

a short distance, upper angle formed by the eyes large and obtuse. The pigment and facets of the eyes do not extend to the margins,

hence there appears to be a space between the eyes (fig. 3). Paired ocelli, elongate transverse, inwardly club-shaped, separated by rather more than a diameter.

Antennae rather shorter than body, basal joint cylindrical, twice as long as broad, sides parallel (fig. 3). Maxillary palpi long and attenuated, ratio of joints—male, $2 : 2\frac{1}{2} : 1\frac{1}{2} : 2 : 3\frac{1}{2} : 3 : 2$; female, $1\frac{1}{2} : 2\frac{1}{2} : 1\frac{1}{2} : 2 : 3 : 2\frac{1}{2} : 1\frac{3}{4}$; joint I with usual processes, inner lobe more pronounced in male, II in male without subapical tooth but with a subapical fleshy lobe (fig. 3). Labial palpi as in fig. 3.

Thorax moderately arched. All legs without coxal stylets. Front femora broader than on middle or hind legs.

Abdomen : sternites as in *M. mexicanus* Silv.

Male : penis short, gonapophyses absent.

Female : ovipositor long, annulated, reaching to tips of lateral cerci.

Length : Body 9 mm., antennae 7 mm., medial cercus ?, lateral cerci 4 mm.

Localities.—Co-types, Delagoa Bay, Oct. 1912, coll. K. H. B.; Krantz kop, Natal, Nov. 1917, coll. K. H. B.; Matroosberg, Hex River Mts., C.P., Jan. 1917, coll. K. H. B.; Clanwilliam, C.P., Sept. 1931, coll. K. H. B.

The following table is appended as a guide to the separation of the known genera of *Machilidae* belonging to the subfamily *Meinertellinae*.

Synopsis of Genera of Meinertellinae.

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 1. Exsertile vesicles on sternites I to VII | 2. |
| Exsertile vesicles only on sternites II-IV. Legs II and III with coxal processes. Paired ocelli triangular | <i>Allomachilis</i> Silv. |
| 2. Coxal processes on legs II and III | 3. |
| Coxal processes only on leg III or wanting | 4. |
| 3. Paired ocelli elongate, transverse, male gonapophyses present or absent | |
| | <i>Machiloides</i> Silv. |
| Paired ocelli triangular. Second joint of max. palpi with sensory hairs on subapical process | <i>Nesomachilis</i> Tillyard. |
| 4. Coxal processes on leg III | 5. |
| Coxal processes wanting on all legs | 7. |
| 5. Eyes large, much deeper than wide. Paired cerci slightly longer than body. Subapical process of joint II of max. palpi not hook-like | |
| | <i>Megalopsobius</i> Silv. |
| Eyes normal, wider than deep | 6. |
| 6. Coxal process on leg III reduced. Male gonapophyses absent | |
| | <i>Hypomachilodes</i> Silv. |
| Coxal process on leg III normal | <i>Machilontus</i> Silv. |
| 7. Male sex without tarsal scopulae | 9. |
| Male sex with dense black tarsal scopulae | 8. |

8. Tarsal scopulae present in both sexes *Meinertellus* Silv.
 Tarsal scopulae confined to male sex *Meinertelloides* Wom.
9. Paired ocelli not elongate, subrotund, and almost touching lower edge of
 eyes *Machilinus* Silv.
 Paired ocelli transverse 10.
10. Eyes large, deeper than wide. Paired ocelli transversely oblique. Medial
 portion of abdominal sternites almost invisible . . . *Macropsontus* Silv.
 Eyes normal. Sternites of abdomen with the medial portion distinctly visible.
 Male genital appendages present or absent . . . *Machilellus* Silv.

11.—*Contributions to the Crustacean Fauna of South Africa.*

By K. H. BARNARD, D.Sc., F.L.S., Assistant Director.

NO. 11. TERRESTRIAL ISOPODA.

(With 80 Text-figures.)

THE following account of the South African Woodlice cannot by any means claim to be exhaustive. Although quite a large collection has been accumulated by the South African Museum, the areas in which collecting has been done are exceedingly small in comparison with the total area under consideration. An enormous amount of work, both in the field and in the laboratory, remains to be done before a monograph of the woodlice can be attempted. This preliminary study, however, may prove useful to future students.

Historically there is but little to say about the woodlouse fauna of South Africa. The first 6 species were described in 1833 by Brandt. Guérin described 1 in 1836, and Krauss 2 in 1843. No further species were recorded during the next forty years, until Budde-Lund published his *Crustacea Isopoda Terrestria* in 1885. Even then only 6 more species were added, some of which had been collected by the botanist J. F. Drege in the course of his travels in the Cape and Natal in the early years of the nineteenth century.*

A gap of ten years followed, until in 1893 the arachnologist Simon travelled in South Africa and collected some woodlice which were described by Dollfus (1895). Seven species were added to the fauna list. Purcell described the curious termitophilous *Phylloniscus* in 1903. In 1904 Budde-Lund revised the genus "Armadillo" and recorded 4 species. The German South Polar Expedition added another species (Budde-Lund, 1906); and Schultze's expedition collected 15 more species (Budde-Lund, 1909).

* See Meyer, E. H. F., Comment. Plant. Afr. Austr. collegit J. F. Drege, Leipsic, 1835. It is interesting to note that Mr. J. L. Drege, who supplied Entomostraca to G. O. Sars through Dr. Purcell, also contributed to this Museum, round about the year 1897, some of the woodlouse material utilised in this paper. I have not been able to discover whether Mr. J. L. Drege was a descendant or relative of the earlier naturalist.

Thus in 1910 Stebbing was able to list 32 (plus 2 introduced) species in his General Catalogue of South African Crustacea. By accident, however, he omitted 6 of Dollfus's species and all the "Armadillos" of Budde-Lund's 1904 revision. On the other hand he admitted 4 species from the Congo,* a region considerably removed from South Africa, even with the wide limits set to it for purposes of this work, viz. as far north as 15° S. lat. (Mossamedes—Mozambique). Stebbing therefore should have listed 43 truly South African species, plus 2 introduced.

In the last two decades 28 species have been added, though some of these are in my opinion synonyms. Including the new species and records in this work, the fauna list at present comprises 139 species, plus 6 introduced species.

This large increase in the fauna list is due to the energy of the past and present members of the staff of the South African Museum, beginning with the late Dr. Purcell and Mr. Lightfoot. In the lists of localities under each species the collectors are acknowledged by their respective initials, thus: Dr. Purcell (W. F. P.), Mr. Lightfoot (R. M. L.), Dr. Haughton (S. H. H.), Mr. Tucker (R. W. E. T.), Mr. Drury (J. D.), Dr. Lawrence (R. F. L.), Dr. Hesse (A. J. H.), Dr. Gill (E. L. G.), Dr. Boonstra (L. D. B.), Mr. Thorne (C. W. T.). The names of authors responsible for already published localities are quoted in full.

The localities in South West Africa, including Ovamboland and the Kaokoveld, will be found in the map accompanying Connolly's report on the Non-marine Mollusca of that region (Ann. S. Afr. Mus., vol. xxix. pt. 2, 1931).

In the following descriptions the colours of the living animals are given whenever I have personally observed them, or the specimens when received at the Museum have been preserved for so short a time as to preclude any great changes. In nearly all cases a prolonged immersion in alcohol causes the usual slaty or greyish colour to fade, at first to a grey and yellowish mottling, and eventually to a uniform pale yellowish. The colours given by Budde-Lund therefore are often misleading. In the colour notes, the word antennae always refers to the second antennae.

Teratology.—Regrettable as it is, attention must be drawn to

* Viz. *Ligia gracilipes* B.-L., *Niambia squamata* B.-L., *Diploexochus (Polyacanthus) aculeatus* B.-L., and *Eubelum lubricum* B.-L. By "South Africa" Budde-Lund (1885) evidently understood Africa south of the equator. The mistake has been followed by Jackson (1922) and Panning (1924).

the illustrations in Collinge's 1919 and 1920 papers. Of the 17 figures of the whole animal in these papers, 7 are abnormal as regards the number of peraeon segments, and 1 also as regards the number of pleon segments; two of them show 8 peraeon segments, four only 6 segments, and one shows only 5 segments; fig. 1 on pl. 14 (1919) also shows 4 pleon segments with expanded pleurae instead of only 3. It is incredible that so many abnormal specimens should have been included in the comparatively small collection submitted to this author. I have never met with any variation in the number of peraeon segments, and I have found only a single reference to such an abnormality (Goto, Annot. Zool. Jap., v, 1906, pl. 279, fig. 8; *Ligia* with 8 peraeon segments). The errors in the figures in question must therefore be ascribed to the artist (though Collinge himself mentions 8 "mesosomatic" segments in *Akermania*, 1919, p. 231); but if mistakes in such a major feature as the number of segments can occur, one's confidence in the accuracy of the details is considerably shaken.

Introduced Species.—In Stebbing's 1910 Catalogue only 2 such species were listed: *Porcellio scaber* and *Porcellionides pruinosus*, Dollfus's record (1895) of *Philoscia elongata* from Cape Town being omitted. The first species was recorded by Budde-Lund (1885) from Cape Town; the second by Dollfus (1895) from Cape Town, Hebron, and Hamman's Kraal. In 1920 Collinge recorded *Philoscia muscorum*, and also *P. pruinosus*, from Natal.

I am now able to report the presence in Cape Town of 2 more species: *Porcellio laevis* and *Armadillidium vulgare*, making a total of 6 introduced species. It is rather surprising that *P. laevis* and *A. vulgare* have not been previously reported, unless they are indeed quite recent importations.

P. pruinosus is the most widely spread species, and it may possibly be of interest to give some of the dates when it was collected, though of course this is no guide as to the date of its actual first appearance in these localities. Hebron and Hamman's Kraal 1893 (coll. Simon), Johannesburg 1898, Clanwilliam 1898, 3 localities in South West Africa 1911 (see Panning 1924), Durban 1912 (K. H. B.), Pietermaritzburg 1915, Zak River 1916, Salisbury 1917, Zululand 1918, Bulawayo 1924, Masiene (Portuguese East Africa) 1924.

Termitophilous and Myrmecophilous Species.—Budde-Lund (1909, p. 66) draws attention to the fact that termitophilous forms belong to the "Ligiids" [*Ligiidae* + *Trichoniscidae*], which like the Termites are an ancient group; whereas the Oniscid forms, e.g. *Platyarthrus*,

Leptotrichus, are found in ants' nests, both Oniscids and ants being of much later evolution.

In South Africa the only truly termitophilous genera, *i.e.* those found only in Termite nests, are *Phylloniscus*, *Schöblia*, *Titana*, and *Kogmania*, all of which belong to the *Trichoniscidae*. It is probable that more of these interesting forms await discovery.

There are no truly myrmecophilous genera or even species apparently. Several species, *e.g.* *Diploexochus saldanhæ*, *pauperculus*, *conisaleus*, have been found in ants' nests under stones, but they may also occur under stones where there are no ants.

Mountain Fauna.—In the course of researches on the fauna of the mountain ranges of the Cape Province, special attention has been paid to the woodlice, with the result that a goodly number of new forms has been discovered. Nevertheless it is certain that many more will be found by further and more intensive collecting.

For the most part the woodlice of the mountain fauna belong to the Armadillidiids (*Diploexochus*). Among the Oniscids the genus *Gerufa* inhabits the upper levels in contradistinction to the allied genus *Niambia* which is characteristic of the plains and lower levels. The most interesting discovery, however, is the presence of several species of primitive Trichoniscids belonging to the genera *Trichoniscus* and *Paranotoniscus*, one of the former being a large cavernicolous form.

So far as can be seen from our present knowledge, the effects of isolation are well marked, and the main mountain ranges and massifs are characterised by their own series of species. But much work remains to be done in tracing out the areas of distribution of species which are hitherto known only from a single locality.

Acknowledgments.—As in the case of my other Crustacean works I am under deep obligations to Dr. Calman of the British Museum. In 1920 Dr. Calman very kindly permitted me to examine the Budde-Lund collection of Terrestrial Isopods and Budde-Lund's MSS. notes, which are preserved in the British Museum. The Budde-Lund MSS. contain several unpublished figures. One of these is here reproduced, and five figures have been drawn from specimens in the Budde-Lund collection.

My thanks are also tendered to Dr. Warren, Director of the Natal Museum, and to Mr. Hewitt, Director of the Albany Museum, for sending me material for examination.

To the Royal Society of South Africa and the Research Grant Board I am indebted for grants-in-aid, which have enabled me to investigate specially the mountain fauna.

The Zoological Survey of Ovamboland and the Kaokoveld, which was carried out by the South African Museum, and produced several interesting species, was sponsored by the Administration of South West Africa.

Key to the families.

(Adapted from Chilton, 1901.)

- I. Mandibles with well-developed molar. Inner lobe of 1st maxilla with 3 plumose setae.
 - A. Uropoda elongate, exposed. 1st antenna 3-jointed, mobile.
 - 1. Flagellum of 2nd antenna many jointed. Two penes . . . *Ligiidae*.
 - 2. Flagellum of 2nd antenna usually not more than 6-jointed. A single penis *Trichoniscidae*.
 - B. Uropoda opercular, concealed under telson. 1st antenna single jointed, immobile *Tylidae*.
- II. Mandibles without molar, its place taken by a brush-like seta or tuft of setae.
 - A. Inner lobe of maxilla 1 with 2 plumose setae.
 - 1. Maxilliped with palp large, well developed, the inner plate acute *Detonidae*.
 - 2. Maxilliped with palp small, feeble, the inner plate truncate.
 - a. Uropoda produced, reaching beyond telson, which is usually narrow and conically produced. Usually unable to roll up into a complete ball *Oniscidae*.
 - b. Uropoda short, not reaching beyond telson, which is usually short and broad. Usually able to roll up into a complete ball *Armadillidiidae*.
 - B. Inner lobe of maxilla 1 with 5-15 plumose setae *Eubelidae*.

The only family which is omitted is *Helleriidae*, which does not occur in Africa (see under *Tylidae*).

FAM. LIGIIDAE.

- 1885. *Ligiae* (part). Budde-Lund, Crust. Isop. Terr., p. 242.
- 1898. *Ligiidae*. Sars, Crust. Norw., ii, p. 155.
- 1907/8. „ (part). Racovitza, Arch. Zool. exp. gen., ser. 4, vol. vii, p. 145, and ix, p. 244.
- 1922. „ Wahrberg, Ark. Zool., xv, 1, p. 67.
- 1928. „ Verhoeff, Zool. Anz., lxxvi, pp. 25-36 and 113-123.

Eyes large. First antenna 3-jointed. Second antenna with multi-articulate flagellum. Mandible with molar, which, however, carries no seta or penicil. Maxilla 1, inner lobe with 3 plumose setae. Maxilliped 7-jointed, *i.e.* with 5-jointed palp arising from the

moderately large 2nd joint. Five pairs of double branched pleopods ; outer (opercular) branches (lobes or rami) without air-cavities. The inner branch of 1st pleopod not modified as a copulatory organ. Uropods not opercular, wholly exposed. Vasa deferentia opening separately at apices of two penes. Five pairs of brood lamellae on peraeon segments 1-5 ; no cotyledons (*cf.* fig. 13, p. 226).

The family is here regarded in the same restricted sense as in Sars' work, namely, excluding the Trichoniscids. It is the most primitive family of woodlice.

Gen. *LIGIA* Fabr.

1795. *Ligia*. Weber, Nomencl. Ent., p. 92.
 1798. „ Fabricius, Suppl. Ent. Syst., p. 301.
 1814. *Ligyda*. Rafinesque, Anal. Nat., p. 101.
 1885. *Ligia*. Budde-Lund, Crust. Isop. Terr., p. 258.
 1893. „ Dollfus, Feuille J. Natur., 3rd ser., 24 année (geogr. distribution).
 1898. „ Sars, Crust. Norw., ii, p. 155.
 1899. „ Chilton, Ann. Mag. Nat. Hist. (7), iii, p. 197 (sexual characters).
 1901. „ *Id.*, Trans. Linn. Soc. Lond., viii, p. 106.
 1905. *Ligyda*. Richardson, Bull. U.S. Nat. Mus., No. 54, p. 673.
 1907. *Ligia*. Hewitt, L.M.B.C. Memoirs, No. 14.
 1916. „ Chilton, Mem. Ind. Mus., v, p. 462.
 1917. „ Tait, Proc. Roy. Soc. Edin., xxxvii, pp. 50-94 (immersion experiments, moulting, limb-taxis).
 1918. „ Hansen, Dan. Ingolf Exp. III, v, p. 201 (peduncle of 2nd antenna).
 1920. *Ligyda*. van Name, Bull. Amer. Mus. Nat. Hist., xliii, p. 72.
 1920. *Ligia*. Collinge, Ann. Nat. Mus., iv, p. 472.
 1922. „ Jackson, Proc. Zool. Soc. Lond., ii, p. 683 (revision and bibliography).
 1922. „ Wahrberg, Ark. Zool., xv, 1, pp. 12, 30, 36, 42, 47, 52.
 1924. „ Panning, Beitr. Kennt. Land. Süsswasserf. S.W. Afr., ii, p. 195 (mouth-parts).
 1924. „ Barnard, Trans. Roy. Soc. S. Afr., xii, p. 29 (gut).
 1925. „ Tait, Scot. Nat. Edin., p. 13 (adaptations to shore life).

1926. *Ligia*. Jackson, Proc. Zool. Soc. Lond., ii, p. 885 (morphology of head).
 1927. „ *Id.*, Ann. Mag. Nat. Hist. (9), xix, p. 129.
 1928. „ *Id.*, Proc. Zool. Soc. Lond., i, p. 569 (morphology of head).
 1928. „ Verhoeff, Zool. Anz., lxxvi, p. 115.
 1929. „ Arcangeli, Ann. Mus. Zool. Napoli, v, p. 15 (brood-pouch).
 1931. „ Nicholls, J. Mar. Biol. Assoc., n.s., xvii, p. 655 (habitat, feeding, gut, etc.).

Telson with postero-lateral angles developed, though often small or only slightly produced. Peduncle of uropod not produced on inner distal angle, rami arising close together, subequal in length.

We owe to Jackson (1922) a valuable revision of this genus, based on an examination of the British Museum material, which includes Budde-Lund's collection. I have also examined this material, but not in the thorough and detailed manner that Jackson has done. In fact I only examined two characters, the penis (more accurately penes) and the 2nd pleopod.

The first of these characters is ignored by Jackson, and of the pleopods he says (p. 687): "I have not found the pleopods to be of any systematic value." On the contrary I find most excellent specific characters in the copulatory stylet on the 2nd pleopod, as well as in the penis.

The penis has been figured by Sars (1898, pl. lxx), Chilton (1899, pl. viii), and Hewitt (1907, pl. iv, fig. 4) for *oceanica*; by Chilton (1901, pl. ii) for *novae-zealandiae*; and by Chilton (1916, fig. 15) for *exotica*. Chilton in both 1901 and 1916 refers to it in connection with the 1st pleopod, and says (1901, p. 113) it "no doubt springs from the last segment of the mesosome but is adherent to the protopodite of the pleopod and in dissection always comes away with it." He also states that it is grooved throughout its length and together with the endopodite (stylet) of the 2nd pleopod forms a tube for the passage of the semen.

The penis does arise from the posterior margin of the 7th peraeon segment, in fact right from the very edge, but in my experience is not adherent to the 1st pleopod, and does not come away with the latter in dissection. Nor do I find that it is grooved. In some species it lies in a groove of the stylet on pleopod 2. These two appendages thus give mutual support, rendering the combined appendage more rigid for purposes of intromission. There would seem to be no object

in the penis being grooved and forming a tube with the stylet, as the orifices of the vasa deferentia are situated at the apex of the penis (Hewitt's 1907 figure is correct, though in the text he says "base"). (Cf. also Arcangeli, 1927, *Ricerche di Morph. e Biolog. Anim.*, ii, No. 2.)

From a taxonomic point of view the penes of *oceanica* and *noxae-zealandiae* are quite distinct. I give figures here of four other types to confirm the specific value of this character. In the South Australian species (which is quite distinct from *novae-zealandiae* as shown by the

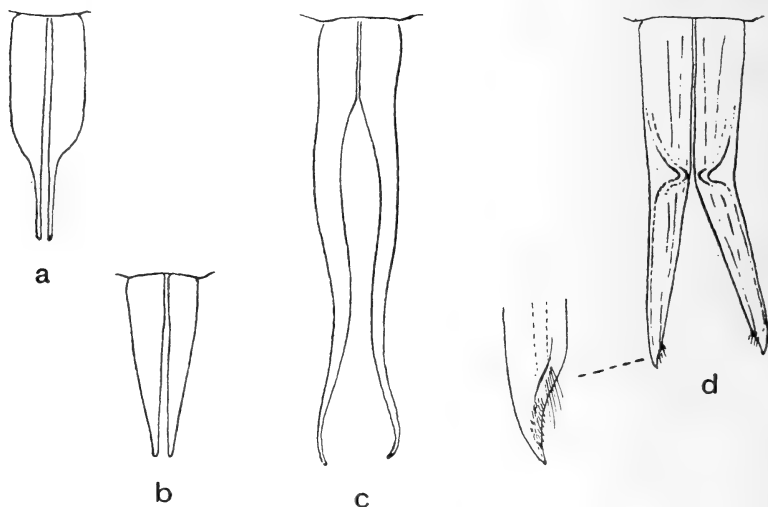


FIG. 1.—*Ligia*. Penes of: *a*, "*flicornis*" B.-L. (MSS.) from Colon (specimen in British Museum); *b*, *exotica*; *c*, a South Australian species; *d*, *dilatata*, *glabrata*, and *natalensis*.

stylet on 2nd pleopod) it is very long (fig. 1, *c*), reaching almost to the end of the telson, as also does the stylet on 2nd pleopod. In the specimen in the British Museum, *ex coll.* Budde-Lund, bearing Budde-Lund's MS. name "*flicornis*," from Colon, the distal portion is abruptly narrower than the basal portion (fig. 1, *a*). In three South African species (fig. 1, *d*) the penis is triquetral in section, and the flat inner surface can be closely adpressed to that of its fellow; the distal portion can be splayed outwards by means of a "pseudo-articulation," a thinning of the chitin.

As regards the stylet on the 2nd pleopod, the figures of Sars, Hewitt, and Chilton indicate that this appendage also is a character of taxonomic importance. The South African species, here figured (fig. 2),

are quite distinct, and for further confirmation future students may be referred to the British Museum collection, where they will find that *pallasii*, *olfersi*, *cinerascens*, "flicornis," for example, show specific differences. Jackson has united *dentipes* B-L. with *exotica*, but the stylet is quite different. New Zealand and South American material of *novae-zealandiae* should be carefully compared, as it may be possible to uphold Dana's *cursor* (cf. Chilton, 1924, N.Z. Journ. Sci. Techn., vi, p. 287).

Panning (1924) has given some interesting details of certain differences in the mouth-parts, and on this basis has suggested a very

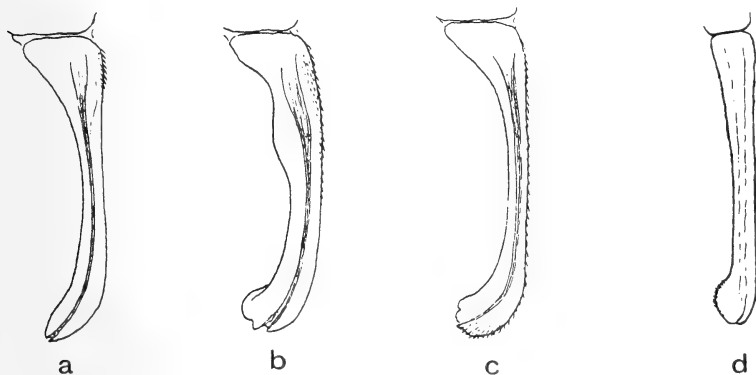


FIG. 2.—*Ligia*. Stylet on pleopod 2 ♂ of : a, *dilatata* ; b, *glabrata* ; c, *natalensis* ; d, *exotica*.

close relationship between the South African species, *dilatata*, *glabrata*, and *natalensis*, and the New Zealand species *novae-zealandiae*. To his observations can be added the fact that the inner plate of the maxilliped of *dilatata* and *natalensis* conform to the type figured by him for *glabrata*, i.e. the apex is rounded and there are 2-3 short conical spines subterminally on the inner margin, proximal to which the margin is setulose.

Four species are known from Africa south of lat. 15° S., but *gracilipes* from Portuguese Congo (Kabinda, 5° S.), as stated in the introduction, is not included.

The first three species are closely allied as regards the penis, peraeopods 1-3 in ♂, outer ramus of 1st pleopod ♂, the ear-like lobes external to bases of 2nd antennae, the telson, and the mouth-parts.

Key to the South African species.

- A. Telson evenly convex between the postero-lateral points.
1. Body in adult ♂ broadly oval. ♂ stylet on pleopod 2 apically pointed.
 - a. Peduncle of antenna 2 fairly stout, reaching end of peraeon segment 2, flagellar joints stout *dilatata*.
 - b. Peduncle of antenna 2 slender, reaching end of segment 3, flagellar joints slender *dilatata* var. *gracilior*.
 2. Body in both sexes elongate oval. ♂ stylet on pleopod 2 apically spatulate.
 - a. Antenna 2 reaching end of peraeon *glabrata*.
 - b. Antenna 2 reaching end of pleon *natalensis*.
- B. Telson with a median point *exotica*.

Ligia dilatata Bråt.(Figs. 1, *d* ; 2, *a* ; 3, *a*.)

1833. *Ligia dilatata*. Brandt, Consp. Oniscid, p. 172 (10).
 1843. „ „ Krauss, Südafrik. Crust., p. 62.
 1885. „ „ Budde-Lund, Crust. Isop. Terr., p. 262.
 1909. „ „ *Id.*, in Schultze, Reise, ii, p. 64.
 1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 437.
 1920. „ „ Collinge, Ann. Nat. Mus., iv, p. 475, pl. xxviii, figs. 19-27.
 1922. „ „ Jackson, Proc. Zool. Soc., p. 701.
 1924. „ „ Barnard, Ann. S. Afr. Mus., xx, p. 236.

Body broadly oval in adult ♂, narrower in ♀ and young, dorsal surface minutely granulate. Antennary tubercles (*i.e.* the ear-like lobes external to the bases of 2nd antennae) more rounded, and their ventral surface less convex, than in *oceanica*. Epimera, except on 1st segment, distinctly separated from tergites by grooves, which, however, are indistinct in young. Pleon considerably narrower than peraeon. Telson with distal margin evenly convex, postero-lateral angles very slightly produced.

Antenna 2 reaching to end of 4th peraeon segment (measured round the margins of segments), peduncle not beyond end of 2nd segment, flagellum 15-18 jointed, joints not twice as long as broad, shortly setose. Mouth-parts as in *glabrata*.

Peraeopods 1-3, 5th joint ovately expanded in ♂, oblong in ♀; 6th joint of peraeopod 7 scarcely 6 times as long as broad.

Penis as figured, apex minutely setulose.

Pleopod 1 in ♂, outer ramus with inner distal angle rounded (not pointed as in *oceanica*). Stylet on pleopod 2 in ♂ apically curved

outwards, acute, the seminal groove opening at apex, inner margin setulose only at base.

Uropods not quite half length of body, rami half as long again as peduncle, which is cylindrical, outer margin not keeled.

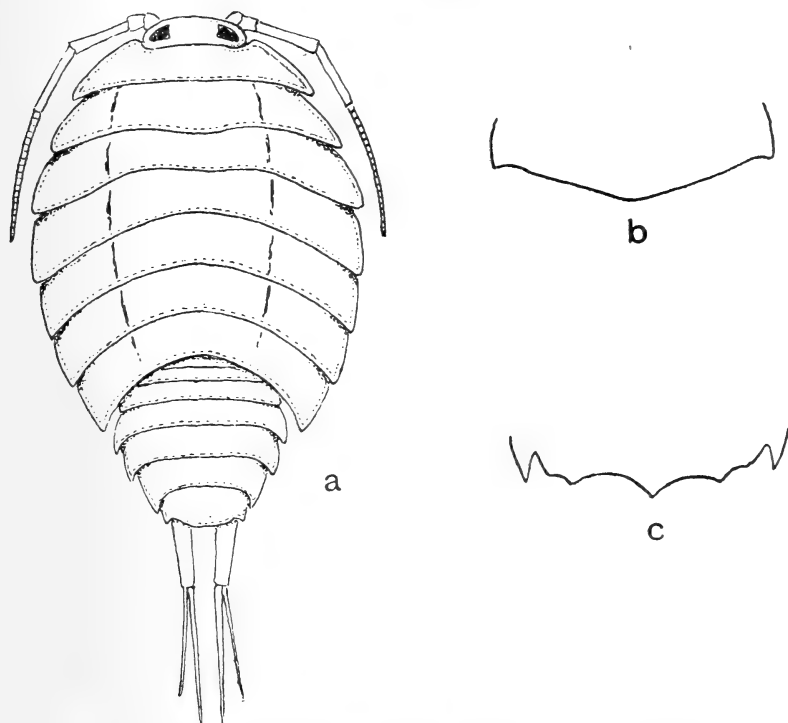


FIG. 3.—*Ligia*. *a*, *dilatata*; *b*, *c*, apical margin of telson of *natalensis* and *exotica* respectively.

♂ 22 × 15 mm., ovigerous ♀ 17 × 9 mm. Greenish-brown or olivaceous, uniform, eyes black.

Localities.—Cape Province: West and east shores of Cape Peninsula (W. F. P. and K. H. B.); Kleinmond, mouth of Bot River, Caledon Div. (K. H. B.).

Great Namaqualand: Lüderitzbucht (Budde-Lund).

Ligia dilatata var. *gracilior* n.

This form cannot be considered as more than a variety of the typical form. Both are found on the Cape Peninsula, but it has not

been determined how far, if at all, the colonies of the two forms overlap.

Adult ♂♂ scarcely grow quite as broad in comparison with the length, as in the typical form. Antenna 2 much more slender, reaching at least to end of 6th peraeon segment, peduncle reaching to end of 3rd segment, flagellum 18–22 jointed, most of the joints twice as long as broad.

Peraeopod 7, 6th joint at least 6 times as long as broad.

Uropods half or a little more than half length of body, rami nearly twice as long as peduncle.

♂ 22×13 mm., ovigerous ♀ 17×9 mm.

Localities.—Cape Province: West and east shores of Cape Peninsula (W. F. P. and K. H. B.); Dassen Island (R. M. L.); Hermanus (R. M. L.).

Ligia glabrata Brdt.

(Figs. 1, *d*; 2, *b*.)

- | | | |
|-------|-------------------------|----------------------------------------------------------------------------|
| 1833. | <i>Ligia glabrata</i> . | Brandt, Consp. Onisc., p. 172 (10). |
| 1843. | „ „ | Krauss, Südafr. Crust., p. 62. |
| 1885. | „ „ | Budde-Lund, Crust. Isop. Terrestr., p. 263. |
| 1895. | „ „ | Dollfus, Mem. Soc. Zool. Tr., viii, p. 350. |
| 1910. | „ „ | Stebbing, Gen. Cat. S. Afr. Crust., p. 437. |
| 1922. | „ „ | Jackson, Proc. Zool. Soc., p. 692, pl. i, fig. 5, pl. ii, fig. 6. |
| 1922. | „ <i>glabratus</i> . | Stebbing, K. Ver. Handl. Goteb., xxv, p. 4. |
| 1924. | „ <i>glabrata</i> . | Panning, Beitr. Kennt. Land. Süßwasserf. S.W.A., vol. ii, p. 195, fig. 11. |
| 1928. | „ „ | Verhoeff, Zool. Anz., lxxvi, p. 123, figs. |

Body narrow-oval in both sexes, dorsal surface minutely granulate. Antennary tubercles on head as in *dilatata*. Epimera, except 1st, which is not marked off at all, indistinctly marked off by grooves. Pleon not much narrower than peraeon. Telson with distal margin evenly convex, postero-lateral angles very slightly produced.

Antenna 2 reaching end of 6th or 7th peraeon segment, peduncle slender, reaching middle or end of 3rd segment, flagellum 15–20 jointed, joints not twice as long as broad, shortly setose.

Maxilla 1, inner plate apically produced in a rounded lobe beyond the origin of the 3 stout setae. Maxilliped with inner plate apically rounded, with 2–3 subterminal short conical spines on inner margin.

Peraeopods 1-3, 5th joint ovate in ♂; 6th joint of peraeopod 7 at least 6 times as long as broad.

Penis as in *dilatata*.

Pleopod 1 in ♂, outer ramus with inner distal angle rounded. Pleopod 2, ♂ stylet slightly enlarged at base, apex spatulate, curving outwards, the margins of the seminal groove ending terminally in short points, outer distal margin thin, laminate, inner margin thickly setulose for nearly three-quarter length.

Uropods not quite half length of body, rami half as long again as peduncle, which is cylindrical with outer margin not keeled.

♂ 18 × 8 mm., ovigerous ♀ 16 × 8 mm. Grey, faintly irrorated with lighter, eyes black.

Localities.—Cape Province: Table Bay (Krauss); West shore of Cape Peninsula (W. F. P. and K. H. B.); Dassen Island (R. M. L.); Dyers Island (Stebbing).

Great Namaqualand: Lüderitzbucht (Panning).

Stebbing's record from Dyers Island (off Danger Point) is the only record from the south coast, and it is possible that his specimens should really be identified as *dilatata* var. *gracilior*.

Ligia natalensis Collge.

(Figs. 1, *d*; 2, *c*; 3, *b*.)

1920. *Ligia natalensis*. Collinge, Ann. Nat. Mus., iv, p. 474, pl. xxviii, figs. 9-18.

1922. „ „ Jackson, Proc. Zool. Soc., p. 700.

Body narrow-oval in both sexes, dorsal surface minutely granulate. Epimera, except first, which is not marked off at all, indistinctly separated. Pleon not much narrower than peraeon. Telson with distal margin not quite evenly convex, but very feebly angular between the quadrate, postero-lateral angles.

Antenna 2 very slender, reaching to middle or end of pleon, peduncle reaching end of 3rd peraeon segment, flagellum 20-24 jointed, joints twice as long as broad, shortly setose. Mouth-parts as in *glabrata*.

Peraeopods 1-3, in ♂ 5th joint ovate; 6th joint of peraeopod 7 at least 6 times as long as broad.

Penis as in *dilatata*.

Pleopod 1 in ♂, outer ramus with inner distal angle rounded. Pleopod 2, ♂ stylet slender, apically spatulate, curving outwards, apex minutely setulose, seminal groove ending laterally in indistinct

Penis straight, slender, evenly tapering.

Pleopod 1 in ♂ outer ramus with inner distal angle not produced. Pleopod 2, ♂ stylet straight, apex rounded, outer apex setulose, seminal groove opening terminally.

Uropods slightly more than half length of body, rami half as long again as peduncle, which is cylindrical with outer margin not keeled.

30 × 17 mm. Slaty-grey, eyes black.

Localities.—Natal : Durban (K. H. B.).

Portuguese East Africa : Mozambique Island
(K. H. B.).

Distribution.—Warm shores of Atlantic, Pacific, and Indian Oceans. On the west coast of Africa it has been recorded from Senegal, and Banana in the Belgian Congo.

FAM. TRICHONISCIDAE.

1898. *Trichoniscidae*. Sars, Crust. Norw., ii, p. 159.

1907/8. „ Racovitza, Arch. Zool. exp. gen., ser. 4,
vols. vii and ix.

1909. „ Budde-Lund in Schultze, Reise, ii, p. 67.

1922. „ Wahrberg, Ark. Zool., xv, pp. 53, 71.

Eyes small or wanting. First antenna 3-jointed. Second antenna with flagellum composed of usually not more than 6 or 7 joints. Mandible with molar, which may or may not carry a brush-like seta or penicil. Inner lobe of maxilla 1 with 3 plumose setae. Maxilliped with palp feebly jointed. Five pairs of double-branched pleopods ; outer (opercular) lobes without air-cavities ; inner lobe of 1st in ♂, as well as that of 2nd, modified as a copulatory organ. Uropods not opercular, exposed, but sometimes partly covered by telson. Vasa deferentia opening separately at apex of a single median penis. Five pairs of brood lamellae or segments 1-5 ; no cotyledons (*cf.* fig. 13, p. 226).

Although separated by Sars, the members of this family have been grouped with the *Ligiidae* by Racovitza and Budde-Lund. In view of the fundamental differences in the anterior pleopods in both sexes, especially in the ♂, it seems better to adopt Sars' classification.

The original Trichoniscids have been divided into a large number of genera and subgenera. The main divisions are based on the structure of the mandible. In the Trichoniscine and Haplophthalmine groups

the molar carries no penicil (not to be confused with the one or more penicils situate *between* the cutting edge or apex and the molar); in the Titanethid group such a penicil occurs on either one or both mandibles.

The South African genera are disposed as follows :—

molar without a penicil	<i>Trichoniscus, Paranotoniscus, Phylloniscus.</i>
molar with a penicil	<i>Kogmania, Titana, Schöblia.</i>

The following key, however, is based on more convenient external characters.

Key to the South African genera.

1. With eyes.
 - a. Pleurae not developed on any segments of pleon *Trichoniscus.*
 - b. Pleurae developed on segments 3-5 *Paranotoniscus.*
2. Without eyes.
 - a. Head produced horizontally over bases of antennae.
 - i. Body nearly circular, depressed *Phylloniscus.*
 - ii. Body ovate, convex *Titana.*
 - b. Head not produced over bases of antennae.
 - i. Broadly ovate, pleon not immersed in peraeon *Kogmania.*
 - ii. Nearly circular, pleon immersed in peraeon *Schöblia.*

Gen. TRICHONISCUS Brandt.

- | | | |
|---------|----------------------|-----------------------------------------------------------------|
| 1833. | <i>Trichoniscus.</i> | Brandt, Consp. Crust. Onisc., p. 12. |
| 1857. | <i>Philougria.</i> | Kinahan, Nat. Hist. Rev., iv, p. 281. |
| 1898. | <i>Trichoniscus.</i> | Sars, Crust. Norw., ii, p. 160. |
| 1901. | „ | Verhoeff, Zool. Anz., xxiv, p. 74. |
| 1901. | „ | Chilton, Tr. Linn. Soc. Lond., viii, p. 114. |
| 1906. | „ | Budde-Lund, Deutsch. Südpol. Exp., ix,
p. 82. |
| 1907/8. | „ | Racovitza, Arch. Zool. exp. gen., ser. 4,
vols. vii and ix. |
| 1928. | „ | Jackson, Proc. Zool. Soc., i, p. 572 (mor-
phology of head). |

Eyes present, consisting usually of 3 ocelli. Pleon abruptly narrower than paraeon, the pleurae not prominently developed. Left mandible with 2 penicils, right mandible with 1 penicil; molar in both mandibles without penicil. Inner ramus of uropod attached at postero-internal angle of peduncle, both rami ending in a tuft of setules.

There are a number of subgenera of *Trichoniscus*, chiefly characterised by differing numbers of penicils in the mandibles. The South

African species described below belong to *Trichoniscus sensu stricto* as defined above.

Some of the European species inhabit caves and grottoes, and it is interesting to find a subterranean species in South Africa.

All the South African species are monticolous. In addition to the species described below, I have found specimens of this genus on Matroosberg, Hex River Mts., and in the southern Cedarberg Mts., east of Citrusdal; but the material is too sparse to justify description. Further collecting in the mountains will certainly bring to light additional species.

Key to the South African species.

- I. Large species, 14 mm. Cavernicolous *tabulae*.
- II. Smaller species, 8 mm. or less.
 - A. Surface nitidulous.
 - 1. Smooth, non-granulate.
 - a. Telson truncate. 4.5-5 mm. *hottentoti*.
 - b. Telson rounded. 3 mm. *natalensis*.
 - 2. Granulate.
 - a. Granules irregularly arranged. 6.5 mm. *ventosus*.
 - b. Granules arranged in transverse series.
 - i. 4 series on peraeon segment 1, and 3 on each of segments 2-7. 4.5 mm. *capensis*.
 - ii. 3 series on peraeon segment 1, and 2 on each of segments 2-7. Head very convex. 4 mm. *moruliceps*.
 - B. Surface shagreened.
 - 1. Non-granulate. 5 mm. *austro-africanus*.
 - 2. Granulate.
 - a. Granules irregularly arranged. 8 mm. *georgensis*.
 - b. Granules arranged in transverse series.
 - i. 2-3 series on segment 1.
 - a. 4 mm. Brownish-grey *horae*.
 - β. 2.5-3 mm. Head and pleon pale, peraeon segments banded *cestus*.
 - ii. 5-6 series on segment 1.
 - a. 4-5 series on segments 2-7. 6.5 mm. *swellendami*.
 - β. 3 series on segments 2-7. 5 mm. *riversdalei*.

Trichoniscus tabulae n. sp.

(Fig. 4.)

Ovate, moderately convex, minutely shagreened, with scattered setules. Head without marked frontal margin, lateral lobes rather well developed; eyes composed of 3 fused ocelli.

Peraeon segments with postero-lateral angles of segments 1-3 rounded-quadrate, of segment 4 quadrate, of segments 5-7 slightly acute. Epimera without oblique keels. The epimera of segments 2-4 in ♀ appear to be not demarcated, but no actually ovigerous ♀♀ have been obtained. Pleurae of pleon segments 3-5 shortly acute, but not projecting. Telson broader than long, apex truncate.

Antenna 1 as in *pusillus* (Sars, pl. lxxii, fig. 1). Antenna 2 with

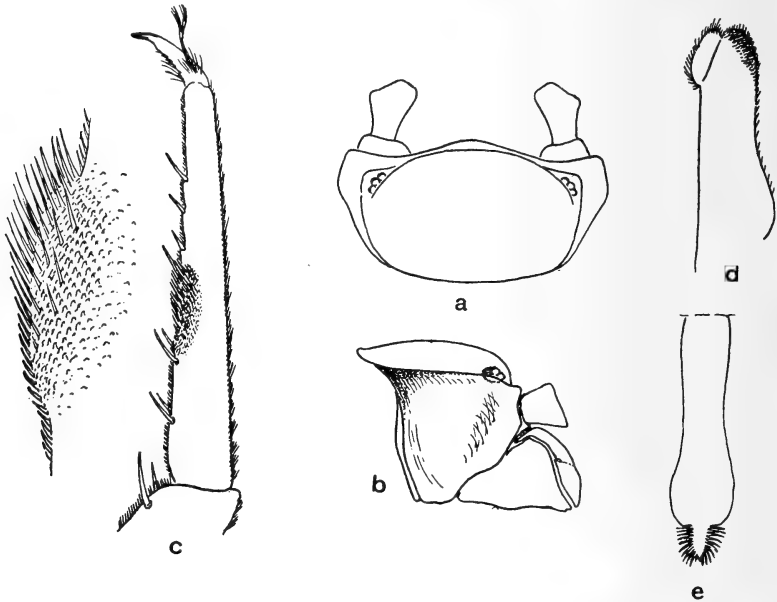


FIG. 4.—*Trichoniscus tabulae* n. sp. a, b, Dorsal and lateral views of head; c, 6th joint of peraeopod 7 ♂, with portion further enlarged (some of the spines omitted); d, maxilla 2; e, penis.

flagellum 10-11-jointed. Mouth-parts as in *pusillus*. Molar without penicil. Outer lobe of maxilla 2 distinctly demarcated.

Peraeopod 7 in ♂, 6th joint with an ovate area in middle of upper surface bearing palisade-like rows of outstanding spines.

Five pairs of brood-lamellae. Penis expanding slightly distally with an apical point bearing spiniform processes on each side. Pleopods 1 and 2 in ♂ as in *Paranotoniscus* (q.v.), the filiform stylet in pleopod 1 apically bifid; the stylet on pleopod 2 more slender and elongate, apically shortly bifid.

Uropod, inner ramus two-thirds length of outer ramus, both narrow, tipped with a few fine setules.

14 × 5.5 mm. Creamy-white, faintly and to a varying degree

suffused with brownish-grey, chiefly on epimera and mid-dorsal line ; antennae, uropods, and peraeopods pale, eyes black.

Locality.—Cape Province : Table Mt., Cape Town (K. H. B.).

This interesting species is found in the caves, known as the Wynberg Caves, on Table Mt., about 80–100 feet below the surface. It has been found only in the lowest of the series of caverns, and is completely shut off from light. The pigmentation appears to be in course of disappearing, but no actual albino specimens have been found. The eyes are as well developed as in other species, and still retain the black pigment.

The associated fauna in this cave comprises a pure white *Peripatus* (*Peripatopsis alba* Lawrence, Ann. S. Afr. Mus., xxx, p. 101, 1931), the curious Acridiid *Speleiacris tabulae* (see Ann. S. Afr. Mus., xxix, pp. 150, 273, 1929), and two species of Harvest-Spiders (see Lawrence, Ann. S. Afr. Mus., xxix, pp. 348, 422, 1931).

Trichoniscus hottentoti n. sp.

(Fig. 5, a.)

Ovate, moderately convex, smooth, nitidulous (even under a high power), with a few scattered setae which are easily lost. Head with frontal margin scarcely marked, lateral lobes small ; eyes with 3 contiguous ocelli, which often appear as if only 2.

Peraeon segments 1–3 with postero-lateral angles rounded, 4–6 quadrate, 7 very shortly produced. Epimera without oblique keels. Pleurae of pleon not projecting. Telson broader than long, apex truncate.

Flagellum of antenna 2 4-jointed. Mouth-parts as in *pusillus*, epipod of maxilliped narrowing evenly to an acute apex.

Peraeopod 7 without sexual differences.

Five pairs of brood lamellae, arising from bases of peraeopods 1–5. Penis expanding very slightly distally, with a filamentous apical point about half the length of the basal part, and minutely serrate at its base on each side (cf. fig. 6 of *Paranotoniscus*, but apical point is here longer). Pleopod 1 in ♂, outer lobe shortly triangular, broader than long, apex blunt, inner lobe with long filiform stylet (cf. *Paranotoniscus*) ; in ♀ outer lobe subtriangular, broader than long, inner lobe small, rounded. Pleopod 2 in ♂, outer lobe transversely oblong, inner lobe with 1st joint short, 2nd elongate, tapering, acute (cf. *Paranotoniscus*) ; in ♀ outer lobe as in ♂, inner lobe narrow, elongate, extending some distance beyond outer lobe, apex subacute.

Uropod, inner ramus three-quarter length of outer, both narrow.

4.5–5 × 1.5–1.75 mm. Chestnut-brown, faintly mottled with lighter marks dorsally, eyes black.

Locality.—Cape Province : Hottentots Holland Mts., 3000–4000 ft. (K. H. B., 1916) ; Wellington Mts., 3000 ft. (K. H. B., 1922).

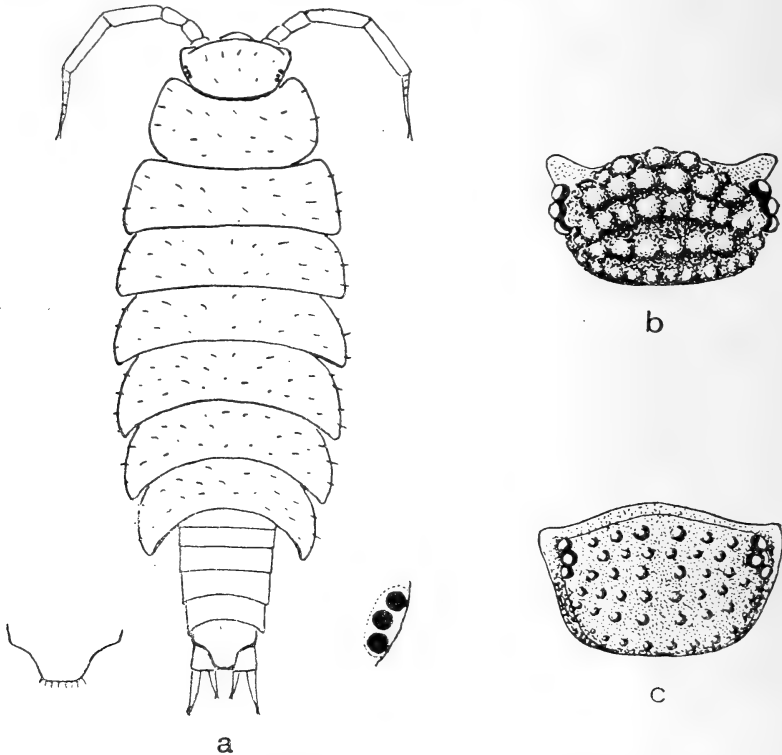


FIG. 5.—*Trichoniscus*. *a*, *hottentoti* n. sp. with eyes and telson further enlarged (the telson in the figure of the whole animal is drawn too long) ; *b*, head of *moruliceps* n. sp. ; *c*, head of *swellendami* n. sp.

Except that there are faint indications of tubercles across each pereon segment, the Wellington Mts. specimens do not differ from those of the Hottentots Holland Mts. The difference scarcely justifies specific separation.

Trichoniscus natalensis n. sp.

Similar to *hottentoti*, but smaller, paler in colour, and with the apex of telson broadly rounded. Epimera of segments 2–4 demarcated in ♀.

3 × 1.25 mm. Pale amber or yellowish, eyes darker.

Locality.—Natal: Pietermaritzburg and Krantz kop (K. H. B., 1917, ♀♀ only).

Trichoniscus ventosus n. sp.

Ovate, smooth, nitidulous, with a few scattered short setules. Head with frontal margin scarcely marked, lateral lobes small; eyes of 3 contiguous ocelli.

Peraeon segments with minute scattered granules, not definitely arranged in transverse series.

Telson nearly twice as wide as long, apex truncate.

6.5 × 3 mm. Slaty-grey, with paler flecks and mottling, eyes black, peduncle of uropods pale.

Locality.—Cape Province: Waaihoek Mts., Goudini, Worcester District (K. H. B., 1928).

The specific name refers to the name of the locality Waaihoek = Windy-corner.

Trichoniscus capensis n. sp.

Resembling *hottentoti*, but head and peraeon with transverse series of low rounded tubercles; 3 series on head, 4 on peraeon segment 1, and 3 series on each of the other segments, the tubercles extending on to the epimera, which have no oblique keels. A single transverse series of granules is faintly indicated on pleon segment 3. Lateral lobes of head rather well developed.

4.5 × 2 mm. Whitish, with faint greyish irroration, eyes black.

Locality.—Cape Province: Table Mt., Cape Town (K. H. B., 1929).

Like *hottentoti* the specimens were collected among damp moss and earth near waterfalls.

Trichoniscus moruliceps n. sp.

(Fig. 5, b.)

Differing from *capensis* in having 3 rows of tubercles on peraeon segment 1, and 2 on each of the other segments, and in the rather more convex occiput with slightly stronger tubercles. The 3 ocelli of each eye are strongly convex and protuberant, whereas in *capensis* (and *hottentoti*) they scarcely project above the general surface of the head; the head consequently bears considerable resemblance to a mulberry.

4 × 1.5 mm. Pale greyish, faintly irrorated, eyes black.

Locality.—Cape Province: Jonkershoek Mts., Stellenbosch (K. H. B., 1924).

The single specimen was found in a Termite nest.

Trichoniscus austro-africanus n. sp.

Resembling *hottentoti*, but larger and with the surface distinctly shagreened. Penis rather more strongly expanded apically, just before the terminal point.

5 × 2.25 mm. Brownish, faintly marbled, eyes black.

Locality.—Cape Province: Table Mt., Cape Town (K. H. B.).

Found in damp moss near streams and runnels.

Trichoniscus georgensis n. sp.

Ovate, shagreened, with a few scattered setules. Head with frontal margin obsolete, lateral lobes well developed, subacute; 3 ocelli in a triangle.

Peraeon and pleon segments with numerous small irregularly arranged granules. Telson twice as broad as long, apex truncate, postero-lateral angles rather sharply quadrate.

8 × 3.25 mm. Slaty-grey, with paler mottling and a pale lateral stripe along the junctions of epimera with their segments, eyes black, peduncle of uropods grey, legs suffused.

Locality.—Cape Province: George (K. H. B., 1931).

Found among humus in the wooded kloofs on the mountain slopes, 2500–3000 ft.

Trichoniscus horae n. sp.

Surface minutely shagreened, with scattered setae. Head smooth, frontal margin not marked, lateral lobes small; eye composed of 3 ocelli, in line on the margin.

Peraeon segment 1 with 2 transverse rows of small rounded tubercles, 6 in each row, and a series of minute granules on hind margin; segments 2–7 each with a single row of 6 tubercles, and minute granules on hind margin. Epimera of segments 2–7 each with a single tubercle in the centre, no oblique keels. Epimera 2–4 very clearly demarcated from their segments in ♀.

Telson broader than long, apically broadly rounded.

4 × 1.75 mm. Brownish-grey, irrorated with paler, eyes black.

Locality.—Cape Province: Swellendam Mts. (K. H. B., 1925, ♀♀ only).

Named after the "Clock" peaks in the vicinity of Swellendam.

Trichoniscus cestus n. sp.

Similar to *horae*, but smaller and differently coloured.

2.5–3 × 1.25–1.5 mm. Head, peraeon segment 1 and the pleotelson pale cream; peraeon segments 2–7 each with a brownish-grey transverse band, which anteriorly is much broken up by pale streaks and spots, the anterior margin being quite clear of dark colouring; eyes black; antennae grey, legs more or less suffused.

Locality.—Cape Province: Riversdale Mts. (K. H. B., 1926).

A pretty and distinctively marked little species.

Trichoniscus swellendami n. sp.

(Fig. 5, c.)

Minutely shagreened. Head without marked frontal margin, lateral lobes moderate; eyes of 3 contiguous ocelli in a triangle; dorsal surface of head with about 6–7 transverse rows of evenly spaced small rounded granules.

Peraeon segment 1 with 5–6 transverse series of small granules; segments 2–7 each with 4–5 series. Epimera without oblique keels.

Pleurae shortly acute, adpressed. Segments 1–3, and less conspicuously also 4, with a transverse series of small granules on hind margin.

Telson broader than long, subtriangular, apex narrowly truncate (but owing to the pale semi-transparent border appearing at first sight to be subtriangular).

6.5 × 2.5 mm. Slaty-grey, head and peraeon variegated with paler, the margins of the segments clearly marked with paler, pleon uniform, eyes black.

Localities.—Cape Province: Swellendam and Riversdale Mts. (K. H. B., 1925 and 1926).

Collected in damp earth and debris at heights of 3500–4000 ft.

Trichoniscus riversdalei n. sp.

Surface minutely shagreened, without setae. Head granulate, frontal margin not marked, lateral lobes moderate, eyes of 3 ocelli arranged nearly in line on margin.

Peraeon segment 1 with 5 transverse series of small rounded tubercles; segments 2–7 each with 3 series, which are continued on to the epimera. Epimera without oblique keels.

Pleon segments 1-3 with minute granules along hind margin ; indications of similar granules also on segments 4 and 5.

Telson broader than long, apically truncate.

5 × 2.5 mm. Pale greyish-cream, eyes black.

Locality.—Cape Province : Riversdale Mts. (K. H. B., 1926).

Paranotoniscus, n.g.

Eyes consisting of 3 ocelli. Antero-lateral angles of head acute. Epimera more or less discontinuous ; 2-4 demarcated in (ovigerous) ♀. Pleurae of pleon segments 3-5 expanded. Mouth-parts and uropods as in *Trichoniscus*.

This genus closely resembles the New Zealand genus *Notoniscus* Chilton (1915, J. Linn. Soc. Lond., xxxii, p. 418), but has better developed pleurae on the 3rd pleon segment, and thus resembles *Haplophthalmus*. Both *Notoniscus* and the present genus differ from *Haplophthalmus* in having 3 ocelli and acute antero-lateral angles of head.

All the species are found in wooded kloofs on the mountains.

Key to the species.

1. Peraeon with 6 series of dorsal tubercles. Pleurae of pleon segment 3 not reaching the marginal outline.
 - a. Pleon segments 1-3 each with 2 dorsal tubercles, segments 4 and 5 each with one tubercle *capensis*.
 - b. Pleon segments 1, 2, 4, 5 without tubercles, segment 3 with a transverse series of 6 tubercles *tuberculatus*.
2. Peraeon with 2 (main) series of dorsal tubercles. Pleurae of pleon segment 3 reaching the marginal outline.
 - a. Length more than twice breadth *montanus*.
 - b. Length twice breadth.
 - i. Pleon segment 1 with medio-dorsal tubercle. No tubercles on hind margin of head *latus*.
 - ii. Pleon segment 1 without tubercle. Head with 2 tubercles on hind margin *ornatus*.

Paranotoniscus capensis n. sp.

(Fig. 6, a-d.)

Elongate-oval, central portion of dorsum convex. Head with prominent medio-frontal tubercle, followed by a large rounded, obscurely tri-tuberculate tubercle, behind which are 2 rounded tubercles ; antero-lateral angles subacute. Eyes with 3 prominent, equidistant

ocelli. Antero-lateral angles of peraeon segment 1 reaching to eyes, rounded; epimera discontinuous; dorsal surface with 6 series of longitudinal tubercles, of which the outermost is the least conspicuous and nearer to its neighbour than the latter is to the submedian tubercle. Pleon segments 1 and 2 with pleurae not developed, segment 3 with acute triangular pleura not forming part of the marginal outline; segments 4 and 5 with well-developed subacute pleurae. Segments 1-3 each with 2 submedian dorsal rounded tubercles; segments 4 and 5 each with a median elongate tubercle

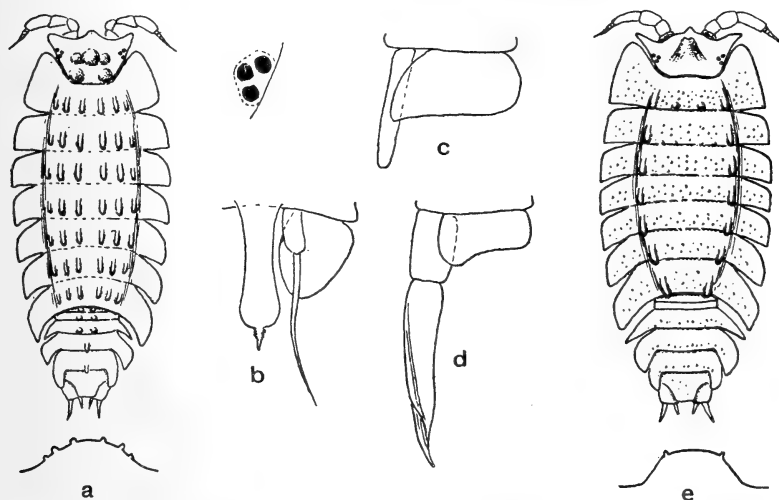


FIG. 6.—*Paranotoniscus* n.g. a, Whole animal of *capensis* n. sp., with eye further enlarged, and diagrammatic cross-section of peraeon; b, penis and pleopod 1 ♂; c, pleopod 2 ♀; d, pleopod 2 ♂; e, whole animal of *montanus* n. sp., with diagrammatic cross-section of peraeon.

slightly overhanging the posterior margin. Telson rather broader than long, apically truncate.

Antenna 1, 1st joint stout, 2nd one-third as long as 1st, 3rd as long as 2nd but abruptly narrower, tipped with 3-4 setules. Antenna 2 stout, 5th joint longer than 4th, flagellum shorter than 5th joint, 4-jointed. Epipod of maxilliped apically subacute.

Peraeopod 7 without sexual differences. Five pairs of broad lamellae arising from bases of peraeopods 1-5. Penis stout, slightly dilated apically, with small apical point which is laterally serrate.

Pleopod 1 in ♂, outer lobe subtriangular, inner lobe narrow, with long filiform stylet; in ♀ not observed, probably very small. Pleopod 2 in ♂, outer lobe short, transverse, inner lobe stout, 2nd joint tapering

to acute apex ; in ♀ outer lobe short, transverse, inner distal angle shortly and subacutely produced inwards, inner lobe moderately elongate.

Uropod, peduncle broad, outer margin straight, outer ramus stout, inner ramus attached near base of inner margin, shorter than outer ramus.

3.5 × 1.5 mm. Pale brown or straw colour, eyes black.

Locality.—Cape Province : Table Mt., Cape Town, 2000–3000 ft. (K. H. B.).

Found under stones in damp places, and in damp moss.

Paranotoniscus tuberculatus n. sp.

Resembling *capensis*, but surface more densely and strongly setulose and papillose ; head strongly convex, without distinct large tubercles, but thickly covered with small tubercles. Peraeon segments with 6 series of tubercles and with additional smaller intervening tubercles, especially on 1st segment. Epimera with an oblique ridge bearing several minute granules. Pleon less strongly convex medio-dorsally than in *capensis* ; pleon segments 1 and 2 without tubercles, segment 3 with a transverse series of 6 tubercles, the outermost one smallest ; pleurae of segment 3 not reaching marginal outline.

2.5 × 1.25 mm. Pale brown, eyes black.

Locality.—Cape Province : Langeberg Range, north of Heidelberg, 2000 ft. (K. H. B., 1927).

Paranotoniscus montanus n. sp.

(Fig. 6, e.)

Elongate-oval, rather strongly convex, minutely granulate and closely setose and papillose, especially near margins. Head with prominent medio-frontal point, followed by a large median tubercle which is apically obscurely bifid ; antero-lateral angles acute. Antero-lateral angles of peraeon segment 1 reaching beyond eyes almost to apices of lateral angles of head. Epimera not so markedly discontinuous as in *capensis*. Dorsum with two series of longitudinal tubercles, more prominent posteriorly, segment 1 also with 2 sub-median rounded tubercles. Pleurae of pleon segment 3 acutely triangular, reaching to marginal outline of segments, 4 and 5 well developed.

In other respects resembling *capensis*.

5 × 2 mm. Pale slaty-grey or chestnut, eyes black.

Locality.—Cape Province: Hottentots Holland Mts., 4000 ft. (K. H. B., 1916).

Found in damp moss near waterfalls.

Paranotoniscus latus n. sp.

Resembling *montanus* but broader, the width equal to half the length, head more deeply sunk in 1st peraeon segment, a median tubercle on hind margin of 1st pleon segment, and the ocelli placed more in a straight line, the hinder two in contact or even fused.

8 × 4 mm. Pale brown or straw-colour.

Locality.—Cape Province: Oudebosch, River Zonder End Mts., Caledon Div. (K. H. B., 1919, 1920, 1928).

Found among damp leaves and humus. Young examples of the same size as *montanus* are easily distinguished by the greater breadth.

Paranotoniscus ornatus n. sp.

Surface much more strongly granulate and papillose than in *latus*, and with additional tubercles. Two tubercles on hind margin of head, one on outer flanks of the dorsal tubercles on segments 1–5, and one at junctions of epimera with their segments on all peraeon segments, these latter tubercles more prominent anteriorly. Pleon with a definite though rounded median ridge, without tubercle on 1st segment, but with a slightly raised hump on segments 4 and 5.

7 × 3.5 mm. Brownish, eyes black.

Locality.—Cape Province: Wellington Mts., 2000–3500 ft. (K. H. B., 1922, 1924, 1931).

Gen. PHYLLONISCUS Purcell.

1903. *Phylloniscus*. Purcell, Trans. S. Afr. Philos. Soc., xiv, p. 409.

Subcircular, depressed. Head broad, subsemicircular, produced horizontally forwards and entirely concealing bases of antennae. Eyes absent. Peraeon segment 1 transverse, not embracing head. Epimera lamellate. Pleon not much narrower than peraeon (except segments 1 and 2); pleurae well developed. Telson broader than long. Right mandible with 1 penicil, left mandible with 2 penicils, molar without penicil in both mandibles. Inner lobe of 1st maxilla with 2 unequal subterminal setae. Inner lobe and palp of maxilliped very short,

epipod obsolete. Peraeopod 7 with sexual differences. Pleopod 1 in ♀ obsolete; inner (branchial) lobe of pleopod 3 rudimentary or obsolete, of pleopods 4 and 5 considerably smaller than outer (opercular) lobe. Inner ramus of uropod lamellate, bearing a single strong spine-seta on inner distal angle, outer ramus terete, with apical tuft of setae.

Budde-Lund's supposition (1909) that this genus should belong to the "Ligiidae" rather than to the *Oniscidae* has proved to be correct. It is closely allied to *Titana* as regards the inner lobe of 1st maxilla, the maxilliped with the obsolete epipod, and the structure of the apical joint of 1st antennae. The mandibles, however, have no penicil on the molar, and therefore, if so much importance be attached to this character, *Phylloniscus* does not belong to the Titanethid group at all.

Phylloniscus braunsi Purcell.

(Fig. 7.)

- | | | |
|-------|-------------------------------|---------------------------------------------------------------------|
| 1903. | <i>Phylloniscus braunsi</i> . | Purcell, <i>loc. cit.</i> , p. 410, figs. 1-3. |
| 1908. | " " | Wasman in Schultze, <i>Reise</i> , i, p. 444,
pl. xxiii, fig. 6. |
| 1909. | " " | Budde-Lund in Schultze, <i>Reise</i> , ii,
pl. lxv. |
| 1910. | " " | Stebbing, <i>Gen. Cat. S. Afr. Crust.</i> ,
p. 438. |

Surface minutely granular. Head with 13-15 radiating ribs, counting one on each postero-lateral margin, central basal part with 3 rows of tubercles, the hindermost row being the most regular and consisting of 6 tubercles. Peraeon segment 1 with 2 rows of tubercles, segments 2-7 each with one row, in which often larger and smaller tubercles alternate. Epimera with 1 rib near anterior margin, and one oblique running to postero-lateral corner. Pleon segments 1-5 each with one row of tubercles, the rows on segments 2-5 without a median tubercle. Pleurae with 2 ribs like the epimera. Telson broader than long, apically rounded (when viewed flat), with 2 longitudinal ribs (when viewed obliquely from above these ribs cause the apex to appear emarginate, as described by Purcell).

Third joint of antenna 1 longer than either 1st or 2nd joints, curved outwards, with numerous papillae on its inner distal surface, comparable with those in *Titana mirabilis* (*cf.* Budde-Lund, 1909, pl. vii, fig. 4). Second maxilla without trace of a lobe on outer distal margin.

Peraeopod 7 in ♂, inner distal angle of 3rd joint with a projecting

lobe set with fine spinules on its margin. Five pairs of brood lamellae arising from bases of peraeopods 1-5. Penis narrow lanceolate, apex acute.

Pleopod 1 in ♂, outer lobe triangular, apex subacute and curving gently outwards, inner lobe narrow with a fine filiform stylet. Pleopod 2 in ♂, outer lobe small, ovate, inner lobe stout, apically acute.

Uropod, inner ramus widening slightly distally, upper surface slightly concave, the inner margin slightly costate.

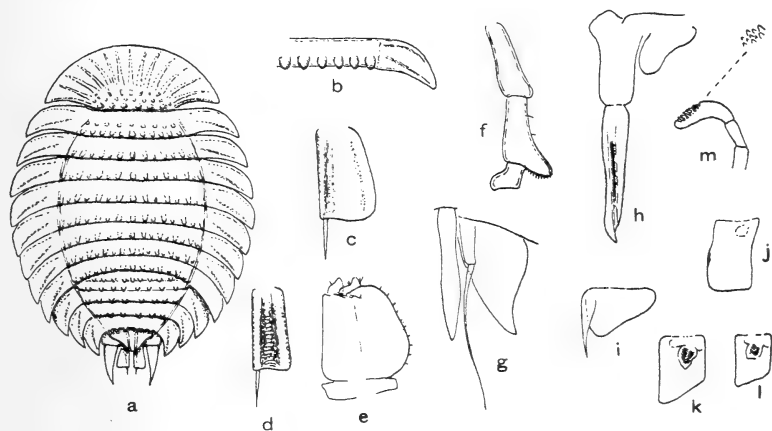


FIG. 7.—*Phylloniscus braunsi* Purcell. a, Whole animal; b, portion of peraeon segment of var. *eutheles* n.; c, d, uropod of typical form and of var. *eutheles*; e, maxilliped; f, 2nd-4th joints of peraeopod 7 ♂; g, penis and pleopod 1 ♂; h, pleopod 2 ♂; i, pleopod 2 ♀; j, k, l, pleopods 3-5 respectively; m, antenna 1.

8 × 7 mm. Cream of whitish.

Localities.—Cape Province: Willowmore and Matjesfontein (Purcell); Laingsburg (R. M. L.); Grahamstown (S.A. Mus.); Garies, Namaqualand (A. J. H.).

Found in the galleries of *Termes viator* and *mossambicus*.

Var. *eutheles* n.

Some specimens from Upington, collected by Father Sollier, resemble the typical form except in the following respects: all the ribs and tubercles are much stronger and more prominent, the tubercles are all of the same size, and stand up on the peraeon segments like rounded buttons; the inner ramus of the uropod is nearly parallel-sided, both inner and outer margins costate, and the upper

surface therefore distinctly grooved. These features are found in the young as well as the adults.

7.25 × 5.75 mm. Creamy white.

The host is not recorded.

Gen. TITANA B-L.

1909. *Titana*. Budde-Lund in Schultze, Reise, ii, p. 65.

Narrow-oval, convex. Head with frontal margin produced forwards over bases of antennae. Eyes absent. Epimera contiguous. Pleon slightly narrower than peraeon, pleurae not expanded. Telson short, rounded. Flagellum of antenna 2 3-jointed. Right mandible with 1 penicil, left mandible with 2 penicils, right molar with penicil. Inner lobe and palp of maxilliped very short, epipod obsolete. Uropod, peduncle slightly longer than broad, longitudinally grooved, rami terete, subcontiguous, with 1-2 apical setae.

Titana mirabilis B-L.

(Fig. 8, a.)

1909. *Titana mirabilis*. Budde-Lund, *loc. cit.*, p. 65, pl. vii, figs. 1-10.

1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 438.

Surface smooth. Five pairs of brood lamellae arising from bases of peraeopods 1-5. *

6 × 2.5 mm. Creamy white.

Localities.—Cape Province: Steinkopf, Namaqualand (Budde-Lund); Upington (S.A. Mus.); Willowmore (S.A. Mus.).

Collected by Dr. Schultze in the nests of *Termes viator*, and by Father Sollier in company with *Phylloniscus braunsi* var. *eutheles*, host unrecorded. The specimens from Willowmore collected by Dr. Brauns are all small and immature, and no host is recorded.

Kogmania n.g.

Broadly oval, depressed. Head with frontal margin raised into a prominent ridge, but not produced forwards over bases of antennae. Eyes absent. Epimera lamellar. Pleon not abruptly narrower than peraeon (except segments 1 and 2), segments 3-5 with well-developed pleurae. Telson short, subtriangular. Peraeopod 7 without sexual

differences. Right mandible with 1 penicil, left mandible with 2 penicils, right molar with penicil. Uropod, rami close together, unequal, tipped with setae.

This genus belongs to the Titanethid group, being closely allied to *Titana* as regards the mandibles.

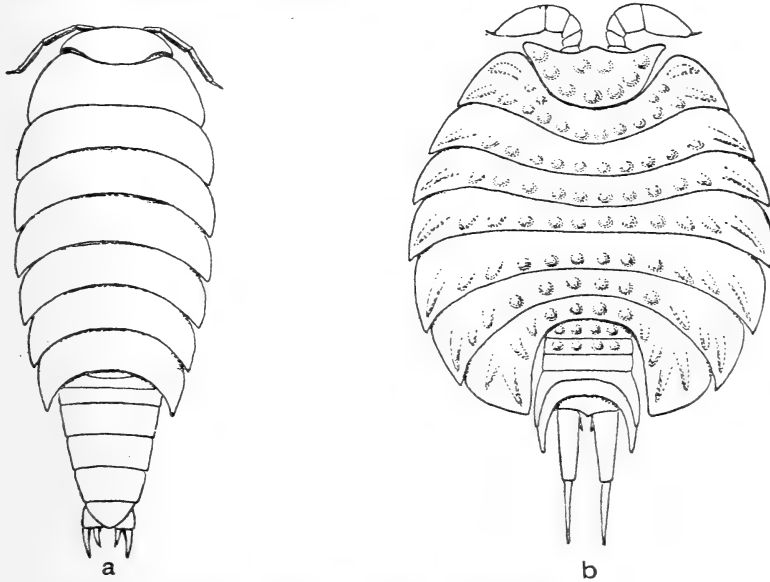


FIG. 8.—*Titana mirabilis* B-L. (left). *Schöbilia fulleri* Silv. (after Silvestri) (right).

Kogmania depressa n. sp.

(Fig. 9.)

Surface minutely granular. Anterior margin of head nearly twice as wide as base, raised into a prominent transverse ridge, arcuate and curving ventrally in the middle. Head and pereon segments each with 2 very low transverse ridges which are feebly tuberculate. Pleon segments 1 and 2 each with a transverse row of feeble tubercles. Telson broader than long, apically rounded in ♂, almost subacute in ♀.

Antenna 1, 3rd joint tipped with a bunch of stiff hooked setae. Antenna 2 stout in ♀ but broken, only two short joints of the flagellum remaining. Inner lobe of maxilla 1 with one subterminal seta. Maxilliped as in *Haplophthalmus* (Sars, 1898, pl. lxxiv), but palp without visible joints, inner lobe narrow, epipod tapering to an acute apex.

Peraeopods stout, not strongly spinose. Five pairs of brood lamellae arising from bases of peraeopods 1-5. Penis tapering evenly.

Pleopod 1 in ♂, outer lobe triangular, inner lobe filiform; in ♀ small. Pleopod 2 in ♂, 2nd joint of inner lobe apically acute; in ♀

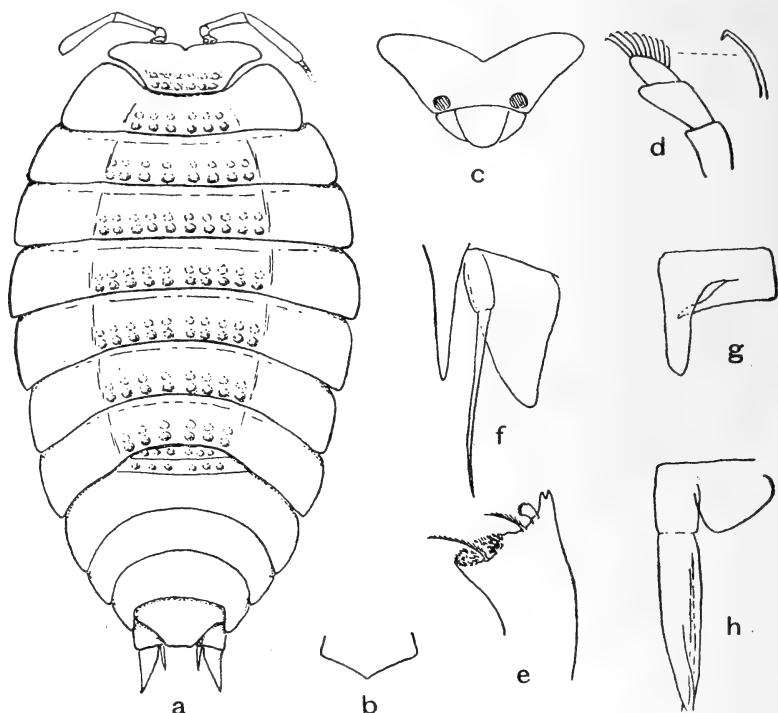


FIG. 9.—*Kogmania depressa* n.g., n. sp. a, Whole animal ♂; b, telson ♀; c, front view of head; d, antenna 1; e, right mandible; f, penis and pleopod 1 ♂; g, pleopod 2 ♀; h, pleopod 2 ♂.

outer lobe small, pointed, and directed transversely inwards, inner lobe narrow elongate, apically blunt.

Uropod, peduncle broader than long, rami arising on distal margin at same level and close together, outer ramus broad, basal width $2\frac{1}{2}$ in length, inner ramus half length of outer, narrow, both tipped with setae.

5 × 3 mm. Creamy white.

Locality.—Cape Province: Kogmans Kloof, Montagu (K. H. B., 1922).

Found under a stone in gallery of a Termite nest.

Gen. *Schöblia* B-L.

1909. *Schöblia*. Budde-Lund in Schultze, Reise, ii, p. 65.

1918. *Termitoniscus*. Silvestri, Boll. Lab. Zool. Portici, xii, p. 290.

Circular, depressed. Head not produced forwards over bases of antennae. Eyes absent. Peraeon segment 1 embracing sides of head; segment 7 embracing pleon. Epimera lamellate. Pleon much narrower than peraeon, pleurae developed into backwardly directed points on segments 3-5 or 4 and 5. Telson transverse, very short. Second antenna with very stout peduncle, flagellum minute, 2-3-jointed. Right mandible with 1 penicil, left mandible with 2 penicils, left molar only with penicil (Budde-Lund), both molars with penicils (Silvestri). Inner plate of 1st maxilla with 3 unequal setae. Maxilliped with basal joint produced on outer distal angle, palp conical (obscurely 2-jointed, Silvestri), inner plate slender, epipod obsolete. Peraeopods similar (♂ unknown). Uropod, peduncle elongate, cylindrical, outer ramus subequal in length, tipped with minute setules, inner ramus attached ventrally near base of peduncle, short, tipped with one seta.

Termitoniscus is clearly synonymous with *Schöblia*, though the two species are distinguishable. The only differences are in the molar penicil, which according to Budde-Lund is present in the left mandible, but in both mandibles according to Silvestri ("mola et appendice eidem mandibulae laevae similibus," but fig. II, 6, does not show the molar penicil very clearly); and in the pleon, of which segments 3-5 are shown produced in Budde-Lund's figure of *circularis*, whereas Silvestri states that only segments 4 and 5 are produced in *fulleri*. With such extraordinarily close resemblances in other respects the union of the two genera is imperative. In fact when more abundant material comes to hand it may prove that only one species should be recognised.

Key to the species.

1. Pleon segments 3-5 acutely produced. 5 tubercles on posterior margin of head.
3 tubercles on pleon segments 1 and 2 *circularis*.
2. Pleon segments 4 and 5 acutely produced. 7 tubercles on posterior margin of head. 4 tubercles on pleon segments 1 and 2 *fulleri*.

Schöblia circularis B-L.

1909. *Schöblia circularis*. Budde-Lund, loc. cit., p. 66, pl. vii, figs. 11-21.

The specific characters are indicated in the key ; in other respects the tubercles are in agreement with those of the following species.

2 × 2 mm. White.

Locality.—Portuguese East Africa : Quilimane (Budde-Lund).

Collected by Dr. Stuhlmann from nest of *Termes monodon*.

Schöblia fulleri (Silv.).

(Fig. 8, b.)

1918. *Termitoniscus fulleri*. Silvestri, *loc. cit.*, p. 292, figs. 1, 2.
(Also published in Ann. R. Scuola Agric. Portici, xv.)

3 × 3 mm. Straw coloured.

Locality.—Portuguese East Africa : Beira (Silvestri).

Collected by Claude Fuller from nest of *Termes bellicosus* f. *mossambica*.

FAM. TYLIDAE.

1885. Budde-Lund, Crust. Isop. Terr., p. 272.

1893. Stebbing, Hist. Crust., p. 423.

1910. *Id.*, Gen. Cat. S. Afr. Crust., p. 439.

Head concrete, with raised shield-like epistome. Eyes large.

Epimera of all the peraeon segments except the 1st demarcated by a distinct suture ; 4th epimeron smaller than the 2nd and 3rd ; 5th–7th epimera large.

Pleon segments distinct, not coalesced. Telson short and broad, transversely oval or subquadragular.

Pronotum extremely narrow, linear (cf. *Pentheus officinalis*).

First antenna single-jointed, immobile. Second antenna stout, flagellum 4-jointed, the 4th joint minute.

Mandible with molar which has 1–4 plumose setae arising below its inner apex, a bunch of several (12–15) penicils between the setose pad and the molar.

Maxilla 1, inner lobe with 3 plumose setae. Maxilla 2 with only a single lobe, apically notched.

Maxilliped, inner plate apically truncate, with several penicils, palp 2–3-jointed, with groups of stout spinules.

Peraeopods stout, 6th joint in the last 3 pairs (in adult) distinctly shorter and stouter than in the anterior 4 pairs ; no sexual differences.

Dactylar seta clavate, present in young, but worn off in older examples.

First pair of pleopods rudimentary in both sexes. Pleopods 2-5 double-branched, the outer branch pleated, branchial.

Peduncle of uropod opercular, covering the anus, invisible dorsally, with a minute terminal outer ramus.

Vasa deferentia opening separately, without penes, on the thin membrane behind the sterna of 7th peraeon segment.

Five pairs of brood lamellae.

Able to roll up into a complete ball.

This family contains the single genus *Tylos*. The genus *Helleria* von Ebner, 1868 (syn.: *Syspastus*, Budde-Lund, 1879, *Syntomagaster*, Costa, 1882, and *Syngastron*, Costa, 1883), is sometimes included in the family (Budde-Lund, 1906, and Calman, 1909). Budde-Lund (1906, p. 73) regards the two genera as the extreme representatives of an ancient and isolated group. Although there are certain characters common to both (epimera 2-7 demarated, maxillae 1 and 2, maxillipeds, and uropods), nevertheless the differences are very great (in *Helleria* pleon segments 1-5 fused, mandible with only one free penicil), and it seems better to place *Helleria* in its own family, *Helleriidae*, as Budde-Lund in 1885 * and Stebbing in 1893 have done. *Helleria* is a mountain woodlouse found in Italy, Corsica, Sardinia, and along the Rivieran coast (see Arcangeli, Atti Soc. It. Mus. Civ. Milan, lii, p. 481, 1914).

The presence of the epimeral sutures, mandibular molar, and 3 plumose setae on inner lobe of maxilla 1 indicate a certain affinity to the *Ligiidae* and *Trichoniscidae*; and I follow Chilton (1901) and Stebbing (1910) in placing the *Tylidae* immediately after these families.

Gen. TYLOS Aud.

- | | |
|-------------------------|-------------------------------------------------------------------|
| 1825. <i>Tylos</i> . | Audouin, Explic. Planches Crust. Egypte, p. 287. |
| 1843. „ | Krauss, Die Südafrik. Crust., p. 63. |
| 1856. <i>Rhacodes</i> . | Koch in Rosenhauer, Die Thiere Andalusiens, p. 422. |
| 1868. <i>Tylos</i> . | von Ebner, Verh. zool. bot. Ver. Wien, xviii, pp. 104 <i>sqq.</i> |
| 1885. „ | Budde-Lund, Crust. Isop. Terr., pp. 273 <i>sqq.</i> |
| 1893. „ | Stebbing, <i>loc. cit.</i> , p. 423 (vindication of name). |
| 1901. „ | Chilton, Trans. Linn. Soc. Lond., 2nd ser., vol. viii, p. 120. |

* The names *Syspasti* B.-L. or *Syspastidae* Arcangeli, 1914, are inadmissible (see Stebbing, 1893, p. 425).

1906. *Tylos*. Budde-Lund, Deutsch. Südpol. Exp., ix, p. 73 (revision).
 1909. „ Holmes and Gay, Proc. U.S. Nat. Mus., xxxvi, p. 376.
 1910. „ Stebbing, J. Linn. Soc. Lond., xxxi, p. 227.
 1910. „ *Id.*, Gen. Cat. S. Afr. Crust., p. 439.
 1922. „ Wahrberg, Ark. Zool., xv, pp. 12, 19, 45, 54 (scale-spines, 1st antenna, maxilliped).
 1924. „ Barnard, Trans. Roy. Soc. S. Afr., xii, p. 29 (gut).
 1928. „ Jackson, Proc. Zool. Soc. Lond., pp. 567, 574 (structure of head).

With the characters of the family.

The genus contains about 15 species (some of which are inadequately described) distributed over the Mediterranean, West Indies, Indo-Pacific, Japan, New Zealand, S. American and South African regions. All the species are beach-dwellers and apparently nocturnal (*v. infra*).

There are several interesting anatomical peculiarities which have not yet been thoroughly studied, owing to the difficulty of obtaining material. Apart from the difficulties of actual collecting, *i.e.* digging in the sand or visiting a particular locality after dark, the internal organs of the animals are extraordinarily difficult to preserve satisfactorily. It is necessary to make one or more insertions in the articular membranes between the segments in the living animal and pour in some strong preservative (95 per cent. strong alcohol with 5 per cent. glacial acetic is a good mixture). Some of the more important features from a taxonomic point of view may be briefly mentioned.

There are two pairs of hepato-pancreatic glands extending almost to the end of the intestine, without anterior extensions, submoniliform in appearance, the two glands on either side opening by a common lateroventral orifice into the posterior end of the stomach. For description and figure of the stomach see Barnard, 1924.

The 2nd to 5th pairs of pleopods are double branched. As Stebbing (1893, p. 423, and 1910, p. 228) remarks, von Ebner in 1868 was perfectly correct in this statement. There is indeed nothing very unusual in the pleopods except that those of pleon segment 1 are rudimentary (*cf.* von Ebner, p. 110). I find, however, that these latter pleopods are present in both sexes. In the 2nd pleopods the peduncle is much reduced; the inner ramus is small in the ♀, but in the ♂ is modified as usual into an intromittent organ. In the 3rd-5th pleopods the peduncle is well developed, and the inner

ramus in both sexes is nearly as large as the outer ramus, but quite thin (fig. 10).

Stebbing (1910, p. 228, and fig. on pl. xxiii) says the uropods are "bilaminar." Even in small specimens, not much larger than Stebbing's, there are not two distinct laminae, but only a thickening of the "opercular" plate on its dorsal (inner) surface forming a circular rim, which coincides closely with the circular opening on the under surface of the telson in which the anus is situated (fig. 11, e).

The vasa deferentia open separately, without external penes, on the delicate membrane of the 1st pleon segment in the sunken groove between the projecting and strongly chitinised sterna of peraeon segment 7 and the 2nd pleon segment. Whether they open actually

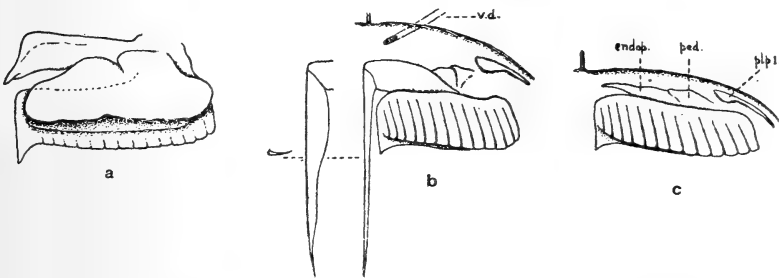


FIG. 10.—*Tylos*. *a*, Inner (dorsal) view of pleopod 3; *b*, outer (ventral) view of pleopod 2 ♂, with stylet viewed from the side and cross-section of same; *c*, outer view of pleopod 2 ♀. In *b* and *c* the hind margin of sternum of 7th peraeon segment and the rudimentary pleopod 1 are shown; in *b* also the opening of one of the vasa deferentia.

on the 1st segment is not certain, as the whole membrane between the 7th peraeon segment and the 2nd pleon segment is very delicate, and there are no definitely chitinised plates representing the sterna of the 1st pleon segment (fig. 10, *b*).

Calman (1909, Crustacea in Lankester's Treatise on Zoology, pt. 7, fasc. 3, p. 212) says it is very improbable that the vasa deferentia "perforate the copulatory appendages of the second pleopod as they have been stated to do in the *Tylidae*." This evidently refers to von Ebner's remarks (1868, pp. 108, 109), but "perforate" is an incorrect rendering of von Ebner's word "münden" ("Die Samenleiter münden . . . jederseits in das hohle Stielplättchen des zweiten Schwanzanhangs, an dem sich die Ruthe befestigt"). From the figure here given, it will be seen that the vasa deferentia discharge their contents opposite to the bases of the stylets.

Von Ebner's description of the stylets (Ruthen, or appendices

masculinae), however, is not correct. He says (*loc. cit.*, p. 108) they form long narrow "Blätte . . . welche im Innern einen Kanal führen, der an der Spitze offen endet." The shape of the stylet in the two South African species is as given in fig. 10, *b*; the dorsal edge is thick and rigid, whereas the ventral edge is thin; in cross-section the stylet is concave on the inside, *i.e.* the side adjacent to its fellow, so that the two stylets together form a channel for the passage of the sperm.

There are the usual five pairs of brood-lamellae (oostegites) in the ♀. As I have not yet succeeded in obtaining any actually ovigerous specimens, it cannot be stated whether the brood-pouch or marsupium projects ventrally (as in *Ligia*, etc.), or is pushed inwards as in the "conglobating" Cubarids (*cf.* p. 226 and fig. 13), nor whether cotyledons are developed or not. (But see Arcangeli, *Ann. Mus. Zool. Univ. Napoli*, vol. v, No. 33, pp. 7, 12, 15, 1929.)

Jackson (1928, p. 575) says the head appears never to have possessed a frontal line. There is, however, as Heller mentioned, a faint impressed line joining the anterior margins of the eyes, though obsolete medio-dorsally, which might well be interpreted as the frontal line.

The rarity of these woodlice in collections seems to be due to their nocturnal habits, as briefly mentioned by Budde-Lund (1906, p. 73, and 1909, *Res. Swed. Exp. Egypt and White Nile*, pt. 3, p. 11). During the day the animals remain buried at a depth of some 6–12 inches in the sand above high-water mark. There is no indication at the surface of where the animal has burrowed down, except in some cases a shallow pit $\frac{1}{2}$ –1 inch in depth. The animals lie rolled up at the bottom of their burrows. At dusk they ascend to the surface and feed on the seaweed and other vegetable matter washed up by the sea.

The subangular particles of food found in the stomach and intestine measure on an average about 1 mm. in diameter, in specimens 30 mm. in length, but some fragments may be longer: $2 \times 1 \times 0.5$ mm.

Some specimens kept for twelve hours in a damp cloth were as lively as when collected. Another batch submerged in fresh water for a similar period were comatose, but revived rapidly on removal from the water.

Key to the South African species.

1. Granulate. Ventral processes of 5th pleon segment large, nearly meeting in middle line in front of uropods, and concealing the 4th and 5th pleopods
granulatus.
2. Smooth. Ventral processes of 5th pleon segment small, not produced medianly, and only partly concealing the 5th pleopods
capensis.

Tylos granulatus Krss.

(Fig. 11, a, b.)

1843. *Tylos granulatus*. Krauss, Die Südafrik. Crust., p. 64,
pl. 4, fig. 5.
1885. „ „ Budde-Lund, Crust. Isop. Terr., p. 275.
1906. „ „ Id., Deutsch. Südpol. Exp., ix, p. 75,
pl. 3, figs. 21-24.
1909. „ „ Id., Schultze, Reise, ii, p. 70.
1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 439.
1924. „ „ Panning, Beitr. Kennt. Land. Süsswas-
serf. S.W.A., ii, p. 172.
1924. „ „ Barnard, Ann. S. Afr. Mus., xx, p. 236.
Surface granulate. Epistome subsemicircular, length $\frac{1}{2}$ — $\frac{2}{3}$ of width.

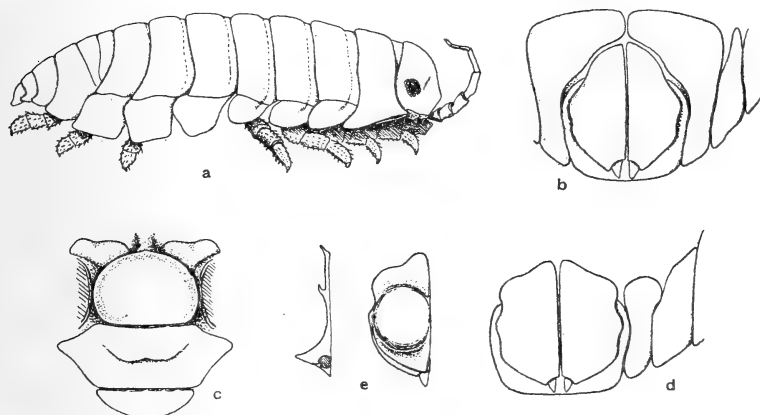


FIG. 11.—*Tylos granulatus* Krss. a, Side view of whole animal; b, ventral view of pleon segments 4 and 5 and telson. *Tylos capensis* Krss.: c, frontal view of antenna 1, epistome, clypeus and upper lip; d, ventral view of pleon segments 4 and 5 and telson; e, inner (dorsal) view of uropod, and profile of inner edge (socket of outer ramus shaded).

Inner margins of pleurae of 5th pleon segment curving inwards, the apices of the pleurae slightly overlapping the dorsal surface of telson. Apical margin of telson convex.

Ventral processes of 4th pleon segment anteriorly subacute, diverging from the ventral processes of 5th pleon segment, which are very large, subtriangularly expanded, meeting in middle line in front of the uropods, and completely concealing both the 4th and 5th pleopods.

Peduncle of uropod subtrigonal.

Up to 50 × 25 mm. Dirty-white or creamy, eyes black.

Localities.—Cape Province : Table Bay (Krauss, also W. F. P.) ; Milnerton and Melkbos Strand (K. H. B.) ; Saldanha Bay (K. H. B.) ; Hondeklip Bay (K. H. B.).

Great Namaqualand : Lüderitzbucht (Budde-Lund and Panning) ; Anichab (Budde-Lund) ; Prince of Wales Bay (Budde-Lund).

Damaraland : Swakopmund (Panning).

A fossil specimen of *Tylos* of probably late Tertiary age has been recorded from the bedded sands above the diamondiferous gravel, oyster line, at Alexander Bay, Namaqualand (Haughton, Trans. Geol. Soc. S. Afr., xxxiv, p. 27, 1931). The granulate surface of the specimen resembles that of *granulatus*, but a definite identification is precluded because the ventral side of the pleon is concealed in hard matrix.

A minute Oligochaet lives among the pleopods. It is 2.5–3 mm. in length, whitish, with 4 bundles of straight and apically simple spines on each segment, usually 3 spines in each bundle. It may be termed *Enchytraeus tyloidis* n. sp.

Tylos capensis Krss.

(Fig. 11, c, d.)

1843. *Tylos capensis*. Krauss, Die Südafrik. Crust., p. 64, pl. iv, fig. 6.

1885. „ „ Budde-Lund, Crust. Isop. Terr., p. 276.

1906. „ „ *Id.*, Deutsch. Südpol. Exp., ix, pp. 73, 74, pl. iii, figs. 14–18.

1906. „ *incurvus*. *Id.*, *ibid.*, p. 79, pl. iii, fig. 41.

1910. „ *capensis*. Stebbing, Gen. Cat. S. Afr. Crust., p. 439.

Surface minutely granulose (smooth in comparison with *granulatus*). Epistome subsemicircular, but slightly longer than in *granulatus* in proportion to its width, length $\frac{2}{3}$ – $\frac{3}{4}$ of width.

Inner margins of pleurae of 5th pleon segment nearly straight, the apices of the pleurae scarcely overlapping telson. Apical margin of telson slightly convex, or almost straight, sometimes even slightly concave.

Ventral processes of 4th pleon segment anteriorly obliquely truncate, approximate to those of the 5th segment which are small, rounded, not expanded medianly, not extending as far forwards as anterior margin of uropods, and only partly concealing the 5th pleopods.

Peduncle of uropod trapezoidal.

Up to 34×15 mm. Dirty-white or creamy, eyes black.

Localities.—Cape Province: Simonstown, False Bay (Budde-Lund); Somerset Strand and Gordons Bay, False Bay (Stebbing); Muizenberg and Strandfontein, False Bay (W. F. P. and K. H. B.); Kleinmond (K. H. B.); Wilderness, near George (K. H. B.); Keurbooms River, Plettenberg Bay Distr. (K. H. B.); Whitney, Alexandria Div. (S.A. Mus.); East London (R. M. L.).
Natal: (Budde-Lund; *incurvus*).

After examination of a large number of specimens, I cannot but regard Budde-Lund's figure 14 (1906) of the epistome as that of an abnormal specimen. There is very little difference between the epistomes of *granulatus* and *capensis*, the latter being only slightly less semicircular than the former.

Budde-Lund's insufficiently described *incurvus* from Natal appears to be synonymous. The concave apical margin of the telson is the only diagnostic character Budde-Lund was able to give, and many specimens of *capensis*, especially when viewed from behind and slightly from the ventral aspect, show a concave margin. The occurrence of *capensis* as far east as East London also points to the likelihood of its presence on the Natal coast. (See fig. 39.)

As regards localities, Krauss recorded this species as well as *granulatus* from Table Bay. This must be regarded as an error in labelling, as all the examples I have seen from Table Bay are *granulatus*, and all those from False Bay are *capensis*. These animals form one of the most marked differences between the faunas of the west and east sides of the Cape Peninsula. If this separation of the two species, one from Table Bay northwards and the other from False Bay eastwards, is proved to be a fact by further and more intensive collecting, it leads to the interesting, though perhaps fruitless, speculation as to why there was no transgression of one species into the area of the other when the sea was continuous across the present Cape Flats between Table Bay and False Bay.

FAM. DETONIDAE.

1853. *Scyphacinae*. Dana, U.S. Expl. Exp., p. 716.
1901. *Scyphacidae*. Chilton, Tr. Linn. Soc. Lond., viii, p. 121
(on p. 103; *Scyphaeidae* typ. err.).
1905. „ Richardson, Bull. U.S. Nat. Mus., No. 54,
p. 671.

1906. *Detoninae*. Budde-Lund, Deutsch. Südpol. Exp., ix, p. 84.
 1910. *Detonidae*. Stebbing, Gen. Cat. S. Afr. Crust., p. 444.
 1915. *Scyphacidae*. Chilton, J. Linn. Soc. Lond., xxxii, p. 437.
 1922. „ Wahrberg, Ark. Zool., xv, p. 80.
 1927. „ Lohmander, Proc. U.S. Nat. Mus., lxxii, art. 17, p. 8.

First antenna, 3-jointed; second antenna, flagellum 3-4-jointed. Mandible without molar, its place taken by a tuft of setae. Inner lobe of maxilla 1 with 2 plumose setae. Maxilliped, palp well developed, longer than inner plate but obscurely jointed. Five pairs of double-branched pleopods; outer (opercular) branches without air-cavities; inner lobe of 1st pleopod in ♂, as well as that of the 2nd pleopod, modified as a copulatory organ. Uropods not opercular, exposed but partly concealed by telson, rami cylindrical. Vasa deferentia opening separately at apex of a single median penis.

The family should take its name from the earliest genus: *Deto* Guérin, 1836. The members of the family are all beach dwellers, and occur on the coasts of North America (both Atlantic and Pacific), Mediterranean, Australasia, S. Pacific Islands, South America and South Africa.

Key to the known genera.

- A. Peduncle of uropod dilated, simulating pleura of pleon.
 1. Outer lobe of maxilla 1 with strong fringe of long setae on outer distal margin *Armadilloniscus* (syn. *Actoniscus*).
 2. Maxilla 1 without such fringe * *Actaecia*.
 B. Peduncle of uropod not dilated.
 1. Outer lobe of maxilla 1 with recurved spines on inner margin *Scyphacella*.
 2. Outer lobe of maxilla 1 with the usual apical spines.
 a. Outer lobe of maxilla 1 with strong fringe of setae on outer distal margin *Scyphoniscus*.
 b. Maxilla 1 without such fringe.
 i. Eyes large, crescentic *Scyphax*.
 ii. Eyes moderate, reniform or subcircular *Deto*.
 iii. Eyes small (6 ocelli) *Detonella*.

Gen. DETO Guérin.

1836. *Deto*. Guérin, Mag. Zool., année vi, notice 21, p. 1.
 1906. „ Budde-Lund, Deutsch. Südpol. Exp., ix, p. 84 *sqq.*
 1915. „ Chilton, *loc. cit.*, p. 437 (monograph of genus).

* Cf. Nicholls and Barnes, Jour. Roy. Soc. West Austr., xii, 1926. Chilton does not mention this feature in his 1901 paper.

1922. *Deto*. Wahrberg, *loc. cit.*, pp. 11, 25, 30, 37, 44, 54, 80.
 1924. „ Panning, Beitr. Kennt. Land. Süßwasserf. S.W.A.,
 ii, p. 183 *sqq.*
 1927. „ Lohmander, *loc. cit.*, p. 9.
 1928. „ Jackson, Proc. Zool. Soc., i, p. 578 (morphology of
 head).

Eyes moderate, reniform or subcircular, with numerous ocelli. Outer lobe of maxilla 1 without recurved spines on inner margin, and without strong fringe of long setae on outer distal margin. Peduncle of uropod not dilated. Five pairs of brood lamellae arising from bases of peraeopods 1-5; a single median cotyledon (see p. 226) on segments 2-5.

The typical species of the genus have the outer ramus of uropod extending much beyond the inner ramus (subgen. *Deto* B-L., 1906), and occur in South Africa, St Paul Island (Indian Ocean), and Australia. The New Zealand and South American species have the outer ramus of uropod not reaching beyond the inner ramus (subgen. *Vinneta* B-L., 1906). A further difference appears to be found in the penis (see p. 224, footnote).

Deto echinata Guérin.

(Fig. 12.)

1836. *Deto echinata*. Guérin, *loc. cit.*, p. 2, pl. xiv.
 1885. „ „ Budde-Lund, Crust. Isop. Terr., p. 234.
 1906. „ „ *Id.*, Deutsch. Südpol. Exp., ix, p. 85, pl. iv,
 figs. 37, 38.
 1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 444.
 1915. „ „ Chilton, *loc. cit.*, p. 440, pl. xxxix, figs. 1-3.
 1915. „ *acinosa*. *Id.*, *ibid.*, p. 441, pl. xxxix, figs. 4-18 (*non*
 Budde-Lund).
 1922. „ *echinatus*. Stebbing, K. Vet. Handl. Goteb., xxv, p. 5,
 pl. i and pl. ii, A.
 1924. „ *echinata* and *acinosa*. Panning, *loc. cit.*, p. 185 *sqq.*,
 figs. 4-9.

Chilton has figured a fully adult ♂ of the typical *echinata* form with the long incurved spines; the spines are not so strongly incurved as represented, the figure evidently intending to indicate the length rather than the actual curvature.

The species, however, grows to a much larger size than Chilton records, viz. ♂ 30 mm. (excl. uropods), ♀ 22 mm.

Panning has endeavoured to distinguish between *echinata* and *acinosa* and *armata*, but although he definitely regards *armata* as a synonym, he seems to have been unwilling to accept *acinosa* as synonymous with *echinata*. He suggests that these two very closely allied species may give rise to hybrids.

To one who has observed this remarkable woodlouse in vast numbers on the beach, and collected handfuls of examples ranging from the

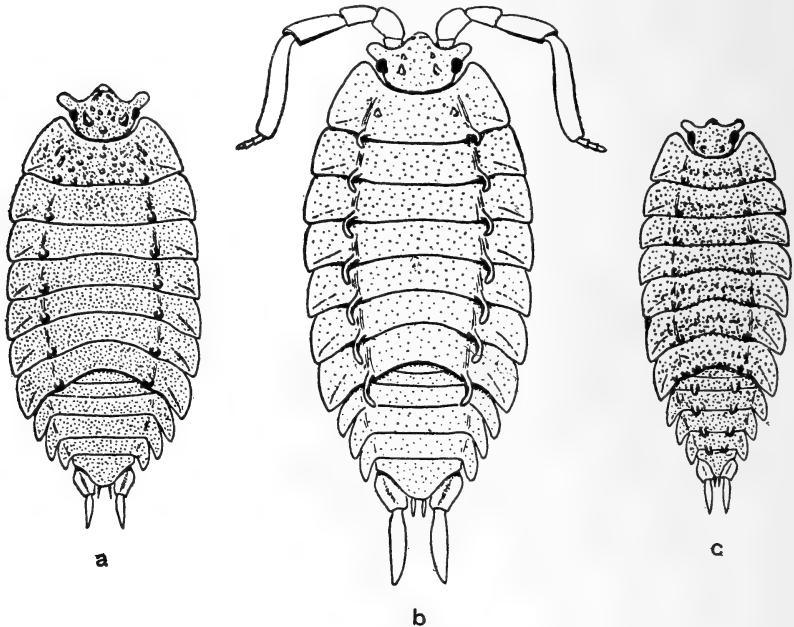


FIG. 12.—*Deto echinata* Guérin. *a*, *b*, ♀ and ♂ of typical form; in the latter the dorsal spines drawn sloping backwards more than they really do; *c*, ♂ of form *acinosa* (= *armata*).

newly hatched (*i.e.* freed from the brood pouch) young of 3·5 mm. up to the largest sizes, there is only one conclusion, namely, that the *acinosa* of Chilton and Panning is only the not fully grown form of *echinata*. The words “not fully grown” are used advisedly, and do not imply that such forms are not sexually mature. Females start breeding when about 13 mm. long, and males of 15 mm. have fully developed copulatory organs and are presumably also sexually mature.

The growth changes are as follows :—

Up to 8–9 mm. no trace of dorsal tubercles, except very faint beginnings of the interocular ones on head.

Up to 12 mm. the dorsal tubercles in ♂ well developed but not longer than 1 mm., in ♀ fully developed.

After reaching a length of about 15 mm. the dorsal projections in ♂ begin to assume the character of spines, and begin to curve inwards. In the largest specimens they reach a length of 6 mm. In the ♀ the projections remain as rounded tubercles.

The typical form has a pair of short tubercles in ♀, and long up-standing spines in ♂, on the head and each peraeon segment. There are often 2 or more low tubercles in front of the spines on head and 1st peraeon segment in both sexes. Pleon without spines or tubercles in both sexes. Size : ♂ up to 30 mm. × 13 mm., ♀ 22 × 9 mm.

Slaty-grey, or greenish, with lighter specks and vermiculations (see Panning, fig. 5); occasionally whole margin of body and the uropods are whitish; often a paler median stripe, which is particularly noticeable as pale patches on peraeon segments 4 and 7 in young and small specimens; eyes black.

Localities.—Cape Province: Table Bay (Krauss, Chilton, also S.A. Mus.); Hout Bay, Cape Peninsula (S.H.H., K.H.B.); Dassen Island (R. M. L.); Lamberts Bay (S.A. Mus.); Dyers Island (Stebbing, also J. D.); Hermanus (Chilton, R. M. L.).

Great Namaqualand: Lüderitzbucht (Panning).

Panning has described 18 and 20 spined forms from Lüderitzbucht along with the typical form, *i.e.* there is a pair of spines on the 3rd pleon segment, or both 3rd and 4th segments respectively.

Form *acinosa* B-L. (1885, Crust. Isop. Terr., p. 235). As described by Budde-Lund this is a smaller and more strongly granulate form than *echinata*. I have found a colony of this form at Kleinmond (C.P.) (February 1927). It is somewhat lighter in colour, with the light patches on peraeon segments 4 and 7 very distinct. Size ♂ 14 × 6 mm., ♀ 13 × 5.5 mm. I have also seen a specimen of this form from Knysna, but I failed to find any specimens of *Deto* near Keurbooms River along the shore of Plettenberg Bay (1931), or on the Natal coast (1912). Thus the most easterly locality for *Deto* is as yet Knysna (fig. 39).

Both sexes of this form are much more strongly granulate, many of the granules being more properly termed tubercles. The spiniform processes on the peraeon in the largest ♂ reach a length of 1 mm. On the posterior segments there is often an extra tubercle outside the normal one, and on segment 7 there may be thus 4 equal-sized tubercles. In addition there are in the ♂ pairs of tubercles on pleon segments 3 and 4, or 2-4, or in the largest specimens 2-5, *i.e.* there are

altogether 12 pairs of spines, as Panning found in *armata* (*loc. cit.*, p. 192, fig. 10). The copulatory appendages are exactly like those of the typical form (*cf.* Chilton, 1915, figs. 14, 15; also Budde-Lund's figure of *armata*, 1909, pl. iv, fig. 36. Contrast with Chilton's figs. 38 and 57 of *aucklandiae* and *bucculenta*).*

If any of the forms is to bear the name of *acinosa*, it would seem to be this small, strongly granulate form, but comparison with Budde-Lund's type is essential. All the examples seen by Chilton (*ex* S.A. Mus.) are typical half-grown *echinata*, and probably also all Panning's examples should be reckoned as *echinata*. There is, however, barring the smaller size (ovigerous ♀♀ from 8 mm.) and stronger granulation of the whole dorsal surface, no tangible feature which will separate *acinosa* from *echinata*.

It also seems that *armata* from St. Paul Island (Indian Ocean) is correctly regarded as synonymous with the *acinosa* form.

This woodlouse occurs in vast numbers among the rocks and boulders from between tide-marks to a short distance above high-water mark, migrating seaward with the ebb and retreating to the shelter of the larger rocks with the incoming tide. It feeds on seaweed and other objects washed up on the beach. Females with ova and broods have been observed during the summer months from November to April.

FAM. ONISCIDAE.

- | | |
|---------------------------------|------------------------------------------------------|
| 1885. <i>Oniscoidea</i> (part). | Budde-Lund, Crust. Isop. Terr., p. 75. |
| 1898. <i>Oniscidae</i> . | Sars, Crust. Norw., vol. ii, p. 169. |
| 1904. <i>Oniscoidea</i> (part). | Budde-Lund, Rev. Crust. Isop. Terr.,
p. 34. |
| 1905. <i>Oniscidae</i> . | Richardson, Bull. U.S. Nat. Mus., No. 54,
p. 592. |
| 1922. „ | Wahrberg, Ark. Zool., xv, p. 86. |

First antenna 3-jointed. Second antenna, sockets usually large, flagellum 1-3-jointed. Mandibles without molar, its place taken by a brush-like seta or tuft of setae. Maxilla 1, inner lobe with 2 apical plumose setae. Maxilliped, inner plate and palp small, almost rudimentary. Penis single. Five pairs of brood lamellae; coty-

* *Deto* (*Deto*) *marina*, of which I have seen examples from Freshwater Bay, agrees with *echinata* in these appendages. Thus there is a further small difference between *Deto* and *Vinneta*. *D. marina* differs from the *acinosa* form in being still more strongly granulate-tuberculate, and in having broader antero-lateral lobes (strictly speaking, antennary lobes) on the head.

ledons present (cf. fig. 13, p. 226). Five pairs of double-branched pleopods, outer branches with or without pseudo-tracheae. Inner branches of pleopods 1 and 2 small or sometimes obsolete. Uropods exposed, produced, extending beyond telson and pleurae of last pleon segment. Usually not able to roll up into a (complete) ball.

It is difficult to separate the *Armadillidiidae* satisfactorily from the present family. Budde-Lund (1904, p. 34) rejected his earlier division, and proposed a new arrangement of subfamilies and tribes. For the sake of convenience Sars is here followed; the Oniscids being forms which usually cannot roll up into a ball, the Armadillidiids being those which can do so.

Although this habit of rolling-up or "conglobating" is not of importance in classification, it has led to a remarkable modification in the position of the brood-pouch in the female. Budde-Lund in 1885 (p. 15) was under the impression that a brood-pouch, formed by the lamelliform oostegites arising at the bases of the pereopods (1-5), was absent in the "Armadilloidea." In 1910 (p. 11) he stated that he had found it in some species of *Armadillidium*, but admitted that negative evidence in other cases was not definite proof of its absence. Omer-Cooper (1926, p. 356) refers to the matter, and shows that in *Periscyphis* the brood lamellae or oostegites are present in ovigerous females. I do not, however, agree with the words he uses: "The young are carried in internal pouches, similar to those found in the *Sphaeromidae*, not in a marsupium formed by the oostegites below the sterna. . . ." In all the forms I have examined, and which are dealt with in this work, the eggs or young are retained in a chamber which is of exactly similar construction both in the conglobating and the non-conglobating forms. The dorsal wall of this chamber is formed by the sterna, the ventral wall by the overlapping oostegites. The only difference is one of position relative to the general shape of the body. In the non-conglobating species the brood-pouch or marsupium bulges ventrally, which obviously prevents the animal from rolling up. In the conglobating species this difficulty is overcome by pushing the whole marsupium, so to speak, into the body of the animal, whereby the gut and the hepatic tubules become considerably squeezed up towards the dorsal body-wall. The oostegites do not bulge, but lie flat, and simulate the true sternal plates. At a casual glance a female of a conglobating species is not patently ovigerous, which fact led to Budde-Lund's former erroneous impression.

The diagrams here given (fig. 13) will show at once why the use

of one term for the brood-pouch of a non-conglobating form, and another term for that of a conglobating form, is not justified. Even the extension and invagination of the membrane between the 5th and 6th sternites cannot be described as an *internal* pouch.*

From the roof of the brood-pouch, *i.e.* from the sternites, several delicate processes hang down. These processes have been termed "cotyledons" (see Zimmer, Handb. Zool., iii, pp. 728, 744, 1926-27).

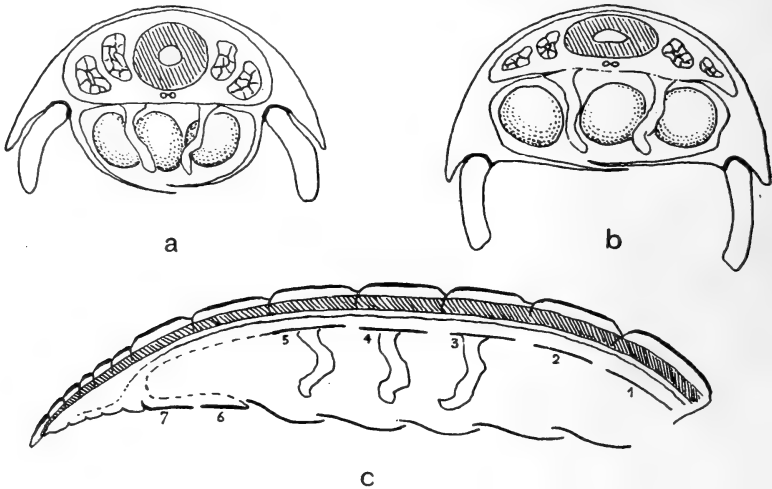


FIG. 13.—*a, b*, Diagrammatic cross-sections of peraeon of "non-conglobating" (*e.g.* *Marioniscus*) and "conglobating" (*e.g.* *Periscyphis* or *Diploexochus*) woodlice, showing gut, hepatic tubules, and cotyledons; *c*, diagrammatic sagittal section of peraeon and pleon of a conglobating woodlouse of the Cubarid type. Nerve-cord represented by a single line; sternites numbered; the dotted line indicates the invaginated extension of the sternal membrane between sternites 5 and 6.

They are always present (in the Oniscine woodlice), though varying in number and position, *e.g.* *Marioniscus spatulifrons* and *Periscyphis kunenensis* have 2-3 on each of segments 3-5, *Nahia hirsuta* and *Bethalus mucidus* have 2-3 on each of segments 2-5 (*cf.* Vandel, Bull. Biol. Fr. Belg., lix, pp. 344 *sqq.*, 1925; and also Arcangeli's remarks on the incubatory pouch, Ann. Mus. Zool. Univ. Napoli, v, No. 23, pp. 6 *sqq.*, 1929).

In order to study successfully the very numerous genera of this family, it is necessary to appreciate some of the anatomical terminology introduced by Budde-Lund. In 1910 he printed in Sjöstedt's Kilimandjaro-Meru Expedition (vol. iii, pp. 8-10), a very handy

* The pouch of the kangaroo is external.

"conspectus morphologicus generum Oniscinarum." The 1st and 5th characters employed in this conspectus can be usefully defined and figured here.

The 1st character is the number of "free" penicils or plumose setae on the mandible, which Budde-Lund explains in his 1909 paper (p. 54). Internal to the "lacinia mobilis" or secondary cutting plate is a setose pad which bears in the left mandible 2 penicils, in the right only 1 penicil. Between this pad and the molar penicil there may be either one "free" penicil (e.g. *Hiatoniscus*, fig. 32) or several penicils (e.g. *Porcellio*, fig. 21). The molar penicil itself varies in composition, as may be seen from the figures of *Philoscia* (fig. 16, a-c).

The other character (5 in the conspectus) concerns the sides of the head. In Budde-Lund's words the "partes pleurales capitis" are either "concretae" or "linea marginali verticali * decurrente manifesto discretae" (1908, p. 296, and 1910, p. 10). Jackson (1928, p. 582), using a somewhat different terminology, describes the latter form of head as having the supra-antennal line meeting the marginal line on the antennary tubercle. But as the terms "concrete" and "discrete" are short and convenient, they are used here. In the discrete head (figs. 16*k*, 20, 21*a*, 29, 33) the marginal line curves down about below the middle of the eye, whereas in the concrete head (figs. 16*l*, 31, 32) it is carried forward to the anterior margin of the eye, where it is more or less distinctly joined to the supra-antennal line. These two types of head are easily observed and distinguished.

Whether all the characters used by Budde-Lund are of importance in separating genera or establishing their inter-relationships may be open to discussion. But if later authors had always taken account of his characters, there would not be several genera (e.g. *Ennurensis*, *Hemiporcellio*, or *Paraniambia*) hanging, so to speak, *incertae sedis* because the characters discussed above were not mentioned.

The structure of the penis is very uniform. That of *Porcellionides* (fig. 22) may be taken as typical. It is lanceolate in shape, more or less expanded at the apex. In cross-section it is subtrapezoidal, thick medianly, with more or less expanded lateral flanges. These lateral flanges are continued slightly beyond the (ventral) acute apex. The ventral surface, *i.e.* the surface facing the observer when

* Jackson (1926, p. 888) translates this as "marginal line of vertex," and points out that the line is not a vertical line as has been assumed. In the present context, however, Budde-Lund evidently means that the pleural parts of the head are separated by the marginal line curving downwards (more or less) vertically.

the animal is laid on its back, is smooth and even. The vasa deferentia run along the dorsal side of the penis, and in contiguity for nearly the whole length.* Distally they diverge to open by separate lateral pores. After discharge the course of the sperm would seem to be guided by a more or less well-developed groove on the distal portion of the stylet (endopod) of pleopod 1. Cf. also Arcangeli, Ric. Morfol. Biol. Anim., i, p. 2, Naples, 1927.

The stylets (endopods) of both pleopods 1 and 2 in the ♂ occasionally exhibit small and inconspicuous differences, which in some cases may be used as specific characters (cf. figs. 15, 18, 22, 25, 29, 31, 32, 33).

Key to the South African genera.

- I. The 2 plumose setae on inner lobe of maxilla 1 very short and stout (fig. 14, e)
Hora.
- II. The 2 setae more or less elongate and slender (fig. 29, e).
 - A. Epistome not bulbous. Palp of maxilliped narrowing to a more or less acute apex, with groups of setae or spinules (fig. 16, g, h).
 1. Flagellum of 2nd antenna 3-jointed.
 - a. Pleon not much narrower than peraeon, the pleurae well developed.
 - i. Convex *Alloniscus*.
 - ii. Depressed *Marioniscus*.
 - b. Pleon abruptly narrower than peraeon, the pleurae small or very small *Philoscia*.
 2. Flagellum of 2nd antenna 2-jointed.
 - a. Head discrete (figs. 16k, 20, 21a, 29, 33).
 - i. Head prominently trilobed. Telson apically produced
Porcellio.
 - ii. Head not prominently trilobed. Telson not apically produced.
 - a. Pleon distinctly narrower than peraeon. Mandible with several penicils . . . *Porcellionides*.
 - β. Pleon not much narrower than peraeon. Mandible with one penicil.
 - * Peduncle of uropod not flattened or excised externally (fig. 24). Telson dorsally impressed. Rudimentary pseudotracheae
Niambia.
 - ** Peduncle of uropod externally flattened and excised (fig. 27). Telson not dorsally impressed. No pseudotracheae *Gerufa*.
 - *** Peduncle of uropod externally keeled and distally excised (fig. 29) . . . *Inchanga*.

* Vandel's statement (Bull. Biol. Fr. Belg., lix, p. 322, 1925) that they fuse, and also his figures 2, A and B, seem to be erroneous. His fig. 12, after Friedrich, is correct.

- b. Head concrete (figs. 161, 31, 32).
 - i. Telson bluntly triangular. Eye submarginal. *Krantzia*.
 - ii. Telson apically produced. Eye marginal. *Hiatoniscus*.
- B. Epistome bulbous (fig. 33). Palp of maxilliped broad, bluntly rounded, without groups of setae or spinules (fig. 33) . . . *Rhyscotus*.

SPHERILLONINE Group.

- 1904. Budde-Lund, Rev. Crust. Isop. Terr., p. 41.
- 1908. *Id.*, in Voeltzkow, Reise, ii, p. 267.
- 1912. *Id.*, Trans. Linn. Soc. Lond., xv, p. 371.
- 1926. Omer-Cooper, Proc. Zool. Soc. Lond., p. 353.
- 1927. Jackson, Insects of Samoa (Brit. Mus.), vol. viii, pt. 3, p. 2.

The distinguishing feature of the series of genera grouped together by Budde-Lund in this subfamily is the 1st maxilla. The two plumose setae on the inner lobe are very short and stout; also there is usually a marked difference in length between the outer and inner groups of spines on the outer lobe, the outermost spine being especially long and strong.

On this character Budde-Lund considered the subfamily well characterised, but apparently there are no collateral characters, and Omer-Cooper doubts whether its separation from the Oniscine series is justified.

Jackson would dispense with the subfamily altogether because the single character of the stumpy setae on maxilla 1 is a character of no taxonomic importance, and seems to have arisen independently in various "genera" which are not otherwise closely related. I agree with Jackson, but use the above heading for the sake of quoting thereunder the relevant literature.

The genera, with short stumpy setae on maxilla 1, are mostly tropical and subtropical. Several species are known from the islands of the Indo-Pacific Ocean and Madagascar, but the species described below is the first to be found in South Africa.

Hora n.g.

Head discrete. Epimeron of 1st segment with entire margin. Epimera of segments 2-4 not demarcated (but no actually ovigerous ♀ observed). Surface with minute slender scale-spines. Telson shortly triangular.

Flagellum of 2nd antenna 2-jointed, 1st joint nearly equal to 2nd. Maxilla 1 with outer 3 spines (Nos. 1, 3, 4) on outer lobe strong, the

1st especially elongate, with a small slender spine (No. 2) at its base, the inner 4 spines much shorter, slender, apices entire; inner lobe with 2 very short and stout plumose setae, outer distal corner rounded.

Dactylar seta filiform, apically blunt.

No pseudotracheae.

Peduncle of uropod externally grooved.

This genus resembles *Paraphiloscia* Stebb., 1900 (*Pseudophiloscia* B-L., 1904), but has a 2-jointed flagellum on antenna 2.

Hora damae n. sp.

(Fig. 14.)

Surface shagreened but otherwise smooth, with scattered minute scale-spines laterally along hind margins of segments, and on telson.

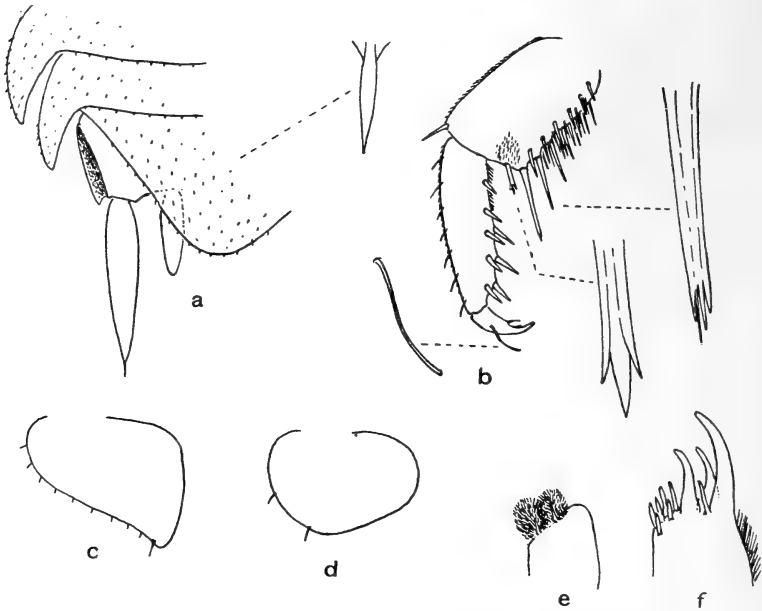


FIG. 14.—*Hora damae* n.g., n. sp. a, Portion of pleon segments 4 and 5, telson, and left uropod, with scale-spine further enlarged; b, distal joints of peraeopod 1 ♂, with spines and dactylar seta further enlarged; c, d, outer ramus of pleopod 1 ♀ and ♂ respectively; e, f, inner and outer lobes of maxilla 1.

Eyes rather small, ocelli 12.

Projecting portions of pleurae $1\frac{1}{2}$ –2 times mid-dorsal length of segments, 5 extending to level of half telsonic length. Telson with sides straight or slightly concave, apex broadly rounded.

Antenna 2 extending to end, or slightly beyond, of peraeon segment 3, slender, 4th joint almost twice 3rd, 5th equal to 3rd plus 4th, flagellum three-quarter length of 5th, its 1st joint nearly as long as 2nd.

Peraeopods 1-4 in ♂ with strong fringe of spines. Dactylar seta of all peraeopods elongate, filiform, apically blunt.

Pleopod 1, outer branch broader than long, in ♂ ovoid, apically blunt, in ♀ subtriangular, apex subacute, outer margin slightly sinuous.

Uropod, peduncle externally flattened and impressed, inner ramus about as long as external margin of peduncle, outer ramus longer.

11 × 3.5-4 mm. Slaty-grey, marbled with whitish or pale yellowish on head and peraeon, pleon uniform, antennae grey, legs and uropods more or less suffused, eyes black.

Locality.—Cape Province: Langeberg Range at Swellendam, 3500-4000 ft. (K. H. B., 1925).

The series of peaks at Swellendam are known as the "Clock" peaks, hence the generic name. This woodlouse is easily recognised by its narrow body, and a glance at the surface ornamentation, uropods, and 1st maxilla will distinguish it from the narrow-bodied *Niambia angusta*. The projecting outer spines of the 1st maxilla are very noticeable, even prior to dissection.

ONISCINE Group.

The 2 plumose setae on inner lobe of 1st maxilla are slender and more or less elongate.

Gen. ALLONISCUS Dana.

- 1854. *Alloniscus*. Dana, Proc. Ac. Philad., vii, p. 176.
- 1885. „ Budde-Lund, Crust. Isop. Terr., p. 224.
- 1904. *Arhina*. Id., Rev. Crust. Isop. Terr., p. 44.
- 1905. *Alloniscus*. Richardson, Bull. U.S. Nat. Mus., No. 54, p. 593.
- 1908. „ Budde-Lund in Voeltzkow Reise, ii, p. 295 (discussion of genus).
- 1912. „ Id., Trans. Linn. Soc. Lond., xv, p. 385.
- 1915. *Arhina* Collinge, Rec. Ind. Mus., xi, p. 147.
- 1916. *Alloniscus*. Chilton, Mem. Ind. Mus., v, p. 474.
- 1922. „ Collinge, J. Linn. Soc. Lond., xxxv, p. 108.
- 1928. *Arhina*. Jackson, Proc. Zool. Soc. Lond., p. 582 (morphology of head).

Convex. Head discrete. Epimera and pleurae large. Telson triangular.

Flagellum of 2nd antenna 3-jointed.

Molar represented by a tuft of setae; 1 free penicil between secondary cutting edge and the molar tuft in both mandibles.

Maxilla 1, outer lobe with all the spines simple.

Maxilliped, inner plate apically setose, with or without a small penicil on inner apex, 2nd joint of palp with 2 tufts of setae on inner margin, 3rd joint with apical tuft (see Budde-Lund, 1904, pl. vi, fig. 11; 1908, pl. xv, figs. 29, 44; and Collinge, 1915 and 1920).

Pleopods, outer branches all with pseudobranchiae.

Uropod, peduncle with outer edge entire.

In adult ♀ some of the epimera are demarcated from their segments by a groove or impressed line free of surface sculpturing.

Budde-Lund instituted the genus *Arhina* for a species which he at first considered an *Alloniscus*, and placed the genus in the "Spherilloninae," far removed from the "Alloniscinae." Collinge (1915) considered *Arhina* closely related to *Alloniscus*, an opinion with which Jackson (1928, p. 583) concurred. That there is no character by which the two genera can be separated seems to be indicated by the fact that specimens from the Chilka Lake in India were described by Collinge in 1915 as a n. sp. of *Arhina*, and in 1916 referred independently by Chilton to *Alloniscus*.

The genus contains a number of very closely related species distributed from California through the Indo-Pacific region to Madagascar and South Africa. The animals frequent the shore.

Alloniscus marinus Collge.

(Fig. 15, a-c.)

1920. *Alloniscus marinus*. Collinge, Ann. Nat. Mus., iv, p. 476, pl. xxix, figs. 28-38.

Ovate, strongly convex, minutely granulate and setulose. Anterior margin of head sinuate, frontal margin not strong, lateral lobes small. Eyes well developed. Epistome slightly gibbous between bases of 1st antennae (cf. Budde-Lund's figure of *pallidulus*, 1909, p. 15, fig. 17). Lateral margins of peraeon segment 1 thin, not reflexed, without internal tooth or groove. Epimera of segments 2-4 in ♀ demarcated by a narrow non-granulate line (cf. *pallidulus* Budde-Lund, 1885, p. 228). Pleurae of pleon segment 5 extending to level

of telsonic apex. Telson broader than long, margins straight, apex blunt.

Peraeopods 1-4, inner margins of 4th and 5th joints with dense fringe of strong spines whose apices are bifid (cf. Wahrberg, 1922, fig. 7, *A. pallidulus*); in ♀ less densely spinose.

Peraeopods 5-7, 4th and 5th joints with strong spines, mostly in pairs, 6th with about 6 strong spines on inner margin; in ♀ rather less strongly spinose.

Dactylar seta of all peraeopods clavate.

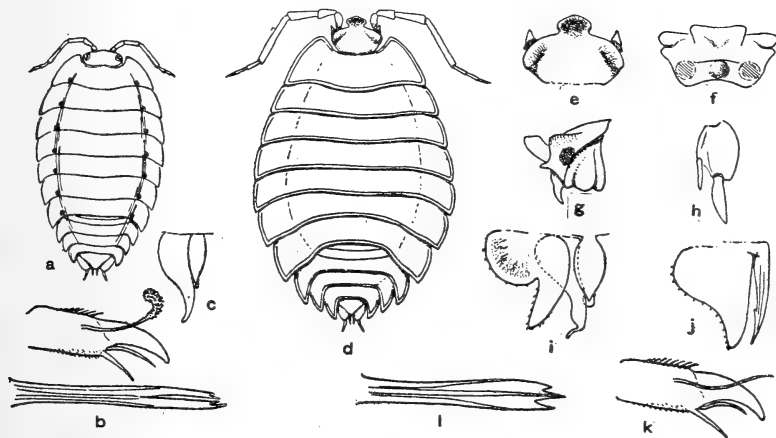


FIG. 15.—*Alloniscus marinus* Clge.: a, Whole animal; b, dactylus and spine from 5th joint of peraeopod 1 ♂; c, penis and pleopod 1 ♂. *Marioniscus spatulifrons* n.g., n. sp.: d, whole animal; e, f, g, dorsal, frontal, and lateral views of head; h, uropod; i, penis and pleopod 1 ♂; j, pleopod 2 ♂; k, dactylus of peraeopod 1; l, spine from 5th joint of peraeopod 1 ♂.

Penis and pleopods as figured by Chilton, 1916 (cf. also Budden-Lund, 1909, pl. xv, fig. 32, *pigmentatus*). Inner branch of pleopods 1 and 2 obsolete in ♀.

Uropod, peduncle oblong, extending a little beyond telsonic apex, outer margin straight, slightly keeled longitudinally on lower outer edge, outer ramus as long as peduncle, inner ramus slightly shorter and more slender than outer, both terete.

12 × 7 mm., alt. 4 mm. As preserved, pale yellowish, suffused with grey mottling, a black spot at junction of each peraeon segment with its epimeron, eyes black.

Localities.—Natal: Durban Bay (Collinge, and S.A. Mus.); Winkle Spruit (Collinge); Amanzimtoti (W.F.P.).
Cape Province: Port St. Johns (S.A. Mus.).

Although closely related to *pallidulus* from the East Indies and Madagascar as regards the epistome (post-frons, Jackson), which I find is slightly gibbous and not slightly concave as Collinge says, this species would seem to be distinguished by the regular series of lateral black spots. I have seen no actually ovigerous females. Collinge's specimens and the South African Museum specimens from Durban Bay were all collected on Salisbury Island at the same time by Mr. H. W. Bell-Marley.

Marioniscus n.g.

Like *Alloniscus* but depressed, head with prominent frontal margin and lateral lobes, dactylar seta acute. Five pairs of brood lamellae.

The following species, for which this genus is proposed, apparently simulates in the development of prominences on the head the Californian species *mirabilis* and *cornutus*, hitherto included in the genus *Alloniscus*.

Marioniscus spatulifrons n. sp.

(Fig. 15, *d-l.*)

Depressed, broadly oval, broader in adult ♂ than ♀, surface minutely granulate. Head with a low rounded ridge running from the posterolateral angle to the front margin forming an "eyebrow" over the eye, front margin produced in a large ovate lobe, deeply concave dorsally, sometimes slightly angular in front, lateral lobes small, narrow, acute, laterally compressed but prominent; epistome with a low rounded median boss. Antero-lateral angles of peraeon segment 1 rounded, reaching to level of eyes. Pleurae of pleon segments 3-5 well developed, apically acute, those of segment 5 reaching slightly beyond level of telsonic apex. Telson broader than long, bluntly triangular, apex rounded.

Antenna 2 reaching to end of segment 2, 2nd joint not expanded on inner margin, 5th half as long again as 4th, flagellum shorter than 5th, 1st and 3rd joints subequal, 2nd slightly shorter.

Peraeopods 1-4, 4th and 5th joints in ♂ with dense fringe of strong spines, whose apices are trifid; in ♀ less strongly spinose.

Peraeopods 5-7, 4th-6th joints with pairs of strong spines, more numerous in ♂ than in ♀.

Dactylar seta in all peraeopods apically acute.

Penis rather broadly lanceolate.

Pleopod 1 in ♂, inner branch tapering to a narrow pointed apex,

which is turned outwards at the tip, inner branch obsolete in ♀; outer branch in both sexes with the outer margin deeply incised.

Pleopod 2, outer branch in ♂ triangular, outer margin sinuous, in ♀ less produced at inner distal angle; inner branch obsolete in ♀.

Uropod, peduncle oblong, slightly widening distally, outer margin straight, entire, rather strongly keeled, outer ramus as long as peduncle, inner ramus arising a little proximal to outer ramus and half its length, both rami terete.

♂ 16 × 10 mm., ♀ 15 × 8 mm.; alt. 2.5–3 mm. Slaty-grey, with lighter marks on head and peraeon, usually a pale medio-dorsal patch on pleon segments 1–3, the concavity of the frontal lobe on head dark grey, almost black; eyes black, antennae, legs, and uropods more or less suffused.

Locality.—Cape Province: Hout Bay, Cape Peninsula (K. H. B.).

This species, which is very distinct from typical *Alloniscus* in the shape of the body, is found on the beach under stones, in company with *Deto echinata*.

Gen. PHILOSCIA Latr.

- | | | |
|-------|--------------------|-----------------------------------------------------------|
| 1804. | <i>Philoscia</i> . | Latreille, Hist. Nat. Crust. Ins., vii, p. 43. |
| 1885. | „ | Budde-Lund, Crust. Isop. Terr., p. 207. |
| 1898. | „ | Sars, Crust. Norw., ii, p. 172. |
| 1908. | „ | Verhoeff, Arch. Biont., ii, p. 343. |
| 1908. | „ | Budde-Lund in Voeltzkow Reise, ii, p. 289
(subgenera). |
| 1917. | „ | Collinge, Ann. Nat. Mus., iii, p. 576. |
| 1922. | „ | Wahrberg, Ark. Zool., xv, p. 92. |

Pleon narrower than peraeon, pleurae small or very small. Telson triangular, apex more or less acute, but not produced. Flagellum of 2nd antennae 3-jointed. Mandible with 1 free penicil. Peraeopods 1–4 more densely setose or spinose in ♂ than in ♀. Pleopods without or with rudimentary pseudotracheae.

The very numerous species of this genus have been distributed among a number of subgenera, with more or less satisfactory results.

In dealing with the South African representatives the characters set out by Budde-Lund have been found consistent and useful, though unfortunately it seems necessary to institute two new subgenera.

Besides the head (*cf.* p. 227), these characters are drawn from the peduncle of the uropod, the molar penicil, the spines on the outer lobe of the 1st maxilla, the inner plate of the maxilliped, and the pleurae. They are illustrated here by fig. 16.

For specific purposes the outer branch of the 1st pleopod in the ♂ may be used in conjunction with other characters; and, with the caution that an occasional individual aberration may occur, will be found reliable. For example, I have seen examples of *hirsuta*, occurring in association with typical examples, in which the proximal point bounding the excision tends to become rounded or obsolete. This

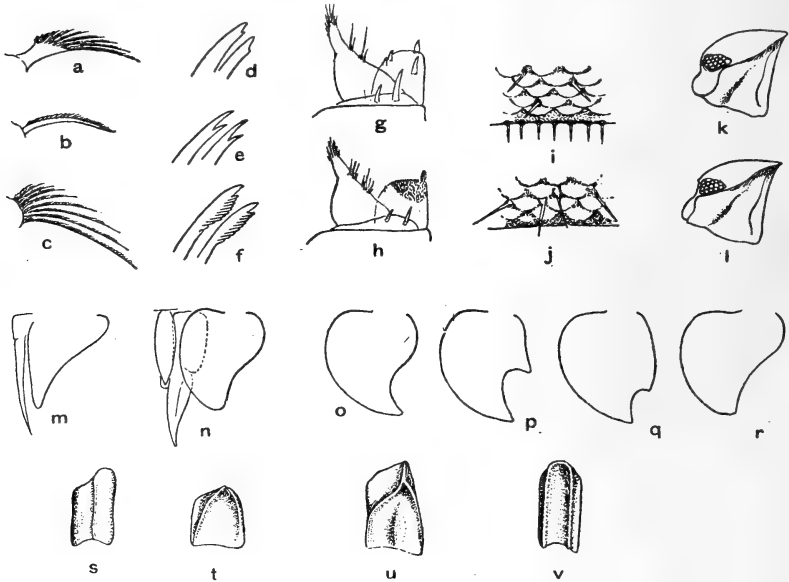


FIG. 16.—*Philoscia*. a, b, c, molar penicil of *P. muscorum*, *Setaphora*, and *Benthanops*; d, e, f, inner spines on outer lobe of maxilla 1 of *P. muscorum*, *Setaphora*, and *Benthanops*; g, h, inner plate and palp of maxilliped of *Aphiloscia* and *Setaphora*; i, j, margin of pleon segment of *Aphiloscia vilis* and *Nahia hirsuta*; k, discrete head of *N. hirsuta*; l, concrete head of *Aphiloscia vilis*; m, n, pleopod 2 ♂, and penis and pleopod 1 ♂ of *A. vilis*; o-r, outer lobe of pleopod 1 ♂ of *S. cingulata*, *N. hirsuta*, *S. demarcata*, and *Benthanops fulva* respectively; s-v, outer view of peduncle of uropod of *Komatia*, *P. muscorum*, *Aphiloscia* and *Setaphora* (also *Nahia*) respectively.

may occur on one side only, its fellow on the opposite side being normal. There are minute differences in the apices of the inner branch of the same appendage, as may be seen from fig. 18.

The 2nd antennae also, it may be noted, are subject to some variation in the proportions of the joints, especially the flagellum, owing to injury when young and consequent rejuvenation. In a long series these points are easily discounted, but single specimens might conceivably lead one astray.

Key to the South African subgenera and species.

I. Eye composed of several ocelli.

A. Head concrete (fig. 16, *l*) *Aphiloscia vilis*.

B. Head discrete (fig. 16, *k*).

1. Peduncle of uropod triangularly excised on outer edge (fig. 16, *t*)

Philoscia muscorum.

2. Peduncle of uropod keeled on outer edge (fig. 16, *s*)

Komatia marginata.

3. Peduncle of uropod grooved on outer edge (fig. 16, *v*).

a. Inner plate of maxilliped hirsute (fig. 16, *h*) . . . *Setaphora*.

i. Postero-lateral angles peraeon segments 5-7 subquadrate.

a. Mottled *mina*.

β. Transversely banded *cingulata*.

ii. Postero-lateral angles peraeon segments 5-7 acute

demarcata.

b. Inner plate of maxilliped spinose (fig. 16, *g*) *Nahia hirsuta*.

II. Eye composed of a single large ocellus *Benthanops fulva*.

Insertae sedis *Philoscia elongata*.

Subgen. *Philoscia*.

Head discrete, no frontal marginal line. Pleurae shortly produced. Molar penicil with several branches arising from a common stalk (fig. 16, *a*). Apex of inner plate of maxilliped spinose. Peduncle of uropod broad, outer margin with slight triangular depression, the lateral keels bounding this depression meeting near base (fig. 16, *t*); inner ramus inserted almost at same level as outer ramus.

Philoscia (Philoscia) muscorum (Scop.).

(Figs. 16, *a, d, t*; 19, *a*).

1763. *Oniscus muscorum*. Scopoli, Entom. Carniolica, p. 415.

1898. *Philoscia* ,, Sars, Crust. Norw., ii, p. 173, pl. lxxvi, fig. 1.

1906. ,, ,, Webb and Sillem, Brit. Woodlice, p. 29, fig. 44 and pl. x.

1920. ,, ,, Collinge, Ann. Nat. Mus., iv, p. 478.

1922. ,, ,, Wahrberg, Ark. Zool., xv, p. 8.

Surface with scattered setules dorsally and laterally, posterior margins of segments with a regular series of setules.

Postero-lateral angle of peraeon segment 7 quadrate, reaching to end of pleon segment 3. Pleurae of segments 3-5 shortly produced, visible in dorsal view, the portions projecting beyond the hind margins

being about half the mid-dorsal length of the segments.* Telson triangular.

Peraeopods 1-3 in ♂, 4th and 5th joints with slender, apically entire spines (fig. 19, *a*).

Pleopod 1 in ♂, outer branch apically bluntly rounded, outer margin sinuous.

Uropod, greatest width of peduncle greater than length of outer margin, outer surface triangularly depressed, but not deeply, inner ramus three-quarter length of outer ramus.

8.5 × 3.5 mm. Reddish-brown or fulvous, with lighter patches, mid-dorsal line dark, antennae and legs more or less banded with light and dark, eyes black.

Localities.—Natal: Hilton Road and Mid-Illovo (Collinge).

Distribution.—Europe, North Africa.

This species is the genotype of the genus *Philoscia*.

The above description is taken from English examples; I have seen no South African specimens. It is evidently a casual importation.

Subgen. *Aphiloscia* B-L.

1908. *Aphiloscia*. Budde-Lund in Voeltzkow, Reise, ii, p. 291.

Head concrete, frontal margin more or less distinct. Pleurae pro-

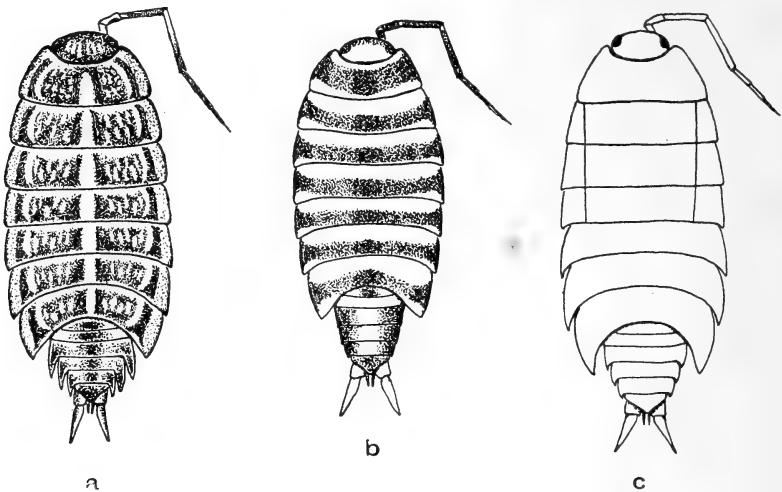


FIG. 17.—*a*, *Aphiloscia vilis* B-L.; *b*, *Setaphora cingulata* n. sp.; *c*, *Setaphora demarcata* ♀ n. sp.

duced. Molar penicil consisting of a single unbranched seta. Apex of inner plate of maxilliped spinose (fig. 16, *g*). Inner spines on outer

* See fig. 24, *c* for these measurements.

lobe of maxilla 1 bifid. Peduncle of uropod broad, outer edge with triangular depression, with a slight bulge in middle, the lateral keels bounding the depression meeting a short distance from base and continued as a single keel to base (fig. 16, *u*); inner ramus arising proximally to outer ramus.

Philoscia (Aphiloscia) vilis B-L.

(Figs. 16, *g, i, l, m, n, u*; 17, *a*; 18, *d*; 19, *c*.)

- | | | |
|-------|-----------------------------|------------------------------------------------------------------------------------------------------|
| 1885. | <i>Philoscia vilis</i> . | Budde-Lund, Crust. Isop. Terr., p. 210. |
| 1908. | <i>Aphiloscia</i> „ | <i>Id.</i> , loc. cit., p. 292. |
| 1910. | „ „ | Stebbing, Gen. Cat. S. Afr. Crust., p. 443. |
| 1917. | <i>Philoscia dilectum</i> . | Collinge, Ann. Nat. Mus., iii, p. 597,
pl. xlii, figs. 21-31. |
| 1920. | „ „ | <i>Id.</i> , <i>ibid.</i> , iv, p. 478, pl. xxvii, fig. 8
(figure shows only 6 peraeon segments). |

Surface with minute scattered setules, regularly spaced short setules on hind margins of segments (fig. 16, *i*).

Postero-lateral angle of peraeon segment 7 quadrate (*cf.* Sars, 1898, pl. lxxvi, *muscorum*), reaching nearly to end of pleon segment 4 (middle of the segment, not end of pleura). None of the epimera demarcated in ♀. Pleurae of pleon segments 3-5 acutely produced, the projecting portions a little longer than the mid-dorsal length of segments, visible in dorsal view. Telson triangular, apically dorsally impressed.

Flagellum of antenna 2 subequal to 5th joint of peduncle, its joints subequal.

Peraeopods 1-3 in ♂, spines on 4th and 5th joints apically slightly expanded and minutely trifid (fig. 19, *c*).

Pleopod 1 in ♂, outer branch apically blunt, outer margin slightly concave (fig. 16, *n*); apex of inner branch, fig. 18, *d*.

Uropod, greatest width of peduncle at least equal to length of outer margin, outer edge triangularly depressed, inner ramus half length of outer ramus.

11 × 5 mm. Plumbeous or greeny-brown, mottled with lighter, but very variable; epimera usually dark, usually a dark stripe laterally (where the epimera merge into the tergites) with a light stripe externally; median line of peraeon and pleon usually light, flanked with dark; telson dark, often with 2 light dots; 1st-3rd joints and

basal half of 5th joint of antennae orange (whitish in alcohol), the rest grey, 2nd joint of peraeopods suffused with grey ventrally; eyes black.

Localities.—Cape Province: East London (Collinge).

Natal: widely distributed. Pietermaritzburg and other localities (Collinge); Inchanga, Port Shepstone, and Scottburgh (K. H. B.); Howick (W. F. P.).

Zululand: M'fongosi (Collinge and W. E. J.).*

Portuguese East Africa: Masiene (R. F. L.).

Transvaal: Sabie Game Reserve (E. L. G.); Kaapmuiden (R. W. E. T.); Louis Trichardt (R. W. E. T.); Zoutpansberg (R. F. L.).

Rhodesia: Bulawayo (R. W. E. T.).

Ovamboland: Mafa, N. of Ondongwa (K. H. B.).

Although the specimen (presumably the type) in the British Museum (*ex coll.* Budde-Lund) is in fragments, comparison with Natal specimens removes all doubt as to the identity of *dilectum* and *vilis*.

The exact locality of the original specimen is unknown; it was collected by the botanist Drege, who travelled widely not only in the Cape but also in Natal (see p. 179).

Komatia subgen. n.

Head concrete, frontal margin distinct. Pleurae produced. Molar penicil consisting of a single unbranched seta. Inner plate of maxilliped spinose. Inner spines on outer lobe of maxilla 1 bifid. Peduncle of uropod broad, outer edge convex, slightly keeled longitudinally (fig. 16, *s*).

Resembling *Aphiloscia* except in the uropod. In this respect there seems to be a resemblance to *Phalaba* B-L., 1910, but in the latter the inner ramus arises far anterior to the outer ramus.

Philoscia (*Komatia*) *marginata* n. sp.

(Figs. 16, *s*; 18, *a*; 19, *d*.)

Surface with minute scattered setules.

Postero-lateral angles of peraeon segment 7 slightly more acute than in *vilis*. Pleurae of pleon segments 3-5 acutely produced, the projecting portions longer than the mid-dorsal length of segments. Telson triangular, apically acute, dorsally impressed.

* A native name, not Mt. [Mount] Fongosi as Collinge writes it.

Flagellum of antenna 2 subequal to 5th joint of peduncle, its 1st joint longest, 2nd slightly shorter, 3rd slightly shorter than 2nd.

Peraeopods 1-3 in ♂, spines on 4th and 5th joints apically trifid (fig. 19, *d*).

Pleopod 1 in ♂, outer ramus as in *vilis*, but apex more acute; apex of inner branch, fig. 18, *a*.

Uropod, greatest width of peduncle equal to length, outer edge convex, with a slight longitudinal keel, outer ramus a little longer than peduncle, stout, outer margin grooved, inner ramus arising almost at same level as outer, stout, $\frac{2}{3}$ length of outer ramus.

11 × 5 mm. Slaty-grey, uniform but slightly irrorated on either

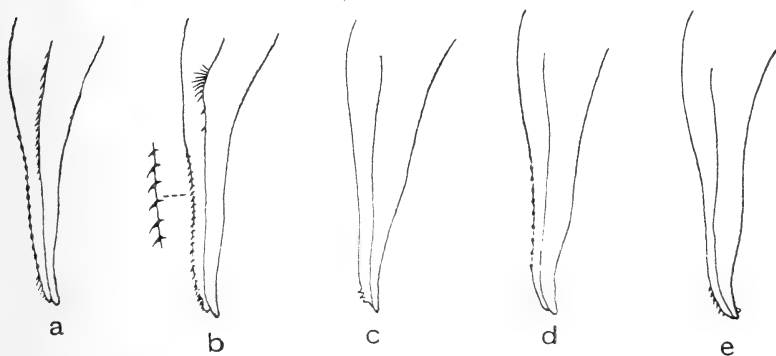


FIG. 18.—Apex of stylet (endopod) of pleopod 1 ♂ of: *a*, *S. demarcati* and *K. marginata*; *b*, *S. mina* and *cingulata*; *c*, *N. hirsuta*; *d*, *A. vilis*; *e*, *B. fulva*.

side of median line, lateral margin of epimeron of segment 2, and postero-lateral corners of epimera of segments 3-7 orange, pleon uniform slaty-grey, uropods orange, 1st-3rd joints and distal half of 5th joint of antennae orange, eyes black.

Locality.—Portuguese East Africa: Wanetsi River (a tributary of the Komati River) (S.A. Mus.).

The South African Museum is indebted to Mr. H. W. Bell-Marley for this interesting species.

Subgen. *Setaphora* B-L.

1908. *Anchiphiloscia*. Stebbing, Proc. Zool. Soc. Lond., May, p. 28, and October, p. 555 (part: *karongae*).

1908. *Setaphora*. Budde-Lund in Voeltzkow, Reise, ii, p. 290.

1912. *Setaphora*. *Id.*, Trans. Linn. Soc. Lond., xv, p. 386 (list of species).

1922. *Anchiphiloscia*. Stebbing, K. Vet. Handl. Goteb., xxv, p. 6.

Head discrete, frontal margin obsolete. Pleurae small, adpressed. Molar penicil consisting of a single unbranched seta (fig. 16, *b*). Apex of inner plate of maxilliped minutely hirsute, with 1 or 2 short plumose setules, but no spines (fig. 16, *h*). Inner spines on outer lobe of maxilla 1 bifid (fig. 16, *e*). Peduncle of uropod longer than broad, outer edge channelled, the bordering keels parallel, not converging basally (fig. 16, *v*); inner ramus arising proximally to outer ramus.

It is a question whether *Anchiphiloscia* Stebb., 26th May 1908, should take precedence over *Setaphora* B-L. Budde-Lund's paper in Voeltzkow, Reise, vol. ii, Heft 4, in which *Setaphora* is fully diagnosed, is quoted by himself as published in 1908, though the cover of Heft 4 bears date 1909, without any month given. Wahrberg quotes the date as 1909.

Budde-Lund (Sjostedts Kilimandjaro Exp., p. 17, 1910) considers the genotype of *Anchiphiloscia*, viz. *karongae*, to be synonymous with *S. suarezi*. On the other hand Stebbing's abstract of 26th May scarcely discloses the differential features of his new genus; and as he accepted the genus *Setaphora* when he revised Budde-Lund's posthumous paper in 1912 (Trans. Linn. Soc., xv, p. 386), while at the same time claiming the priority of his *Paraphiloscia* 1900 over Budde-Lund's *Pseudophiloscia* (*loc. cit.*, 1912, p. 372, footnote), we may allow *Setaphora* to stand.

Moreover, Stebbing in 1922 records his own species *A. karongae* with the second species *cunningtoni* as a synonym, so that evidently he neither regarded his genus as the same as *Setaphora*, nor agreed with Budde-Lund (1910) that *cunningtoni* and *karongae* belonged to two separate subgenera.

The final decision rests on the actual date of Budde-Lund's 1908 paper, and the re-examination of Stebbing's species *karongae*.

Philoscia (*Setaphora*) *mina* B-L.

(Figs. 18, *b*; 19, *e*.)

1885. *Philoscia mina*. Budde-Lund, Crust. Isop. Terr., p. 219.

1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 443.

(Non *mina* Dollfus, 1893. Seychelles.)

Surface sometimes with a few setules laterally, none on hind margins of segments.

Postero-lateral angles of peraeon segment 7 rounded-quadrate (blunter than in *muscorum*), scarcely reaching end of pleon segment 3. Pleurae of segments 3-5 very short, adpressed, not visible in dorsal view, about one-quarter mid-dorsal length of segments. None of the epimera demarcated in ♀. Telson triangular, apex acute in large specimens, but frequently rounded in young examples, slightly impressed dorsally.

Antenna 2 slender, 5th joint longer than 4th, flagellum equal to 5th joint.

Peraeopods 1-3 in ♂, spines on 4th and 5th joints apically bifurcate, each branch apically bifid (fig. 19, e).

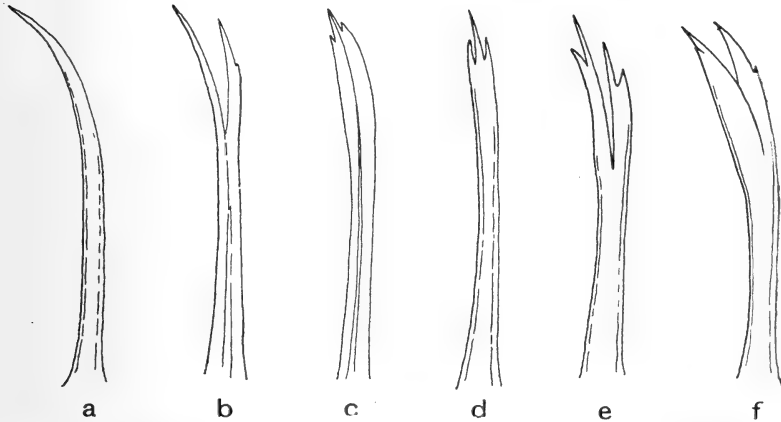


FIG. 19.—Spines from 5th joint of peraeopods 1-3 ♂ of: a, *P. muscorum*; b, *S. cingulata* and *demarcata*; c, *A. vilis*; d, *K. marginata*; e, *S. mina*; f, *N. hirsuta* and *B. fulva*.

Pleopod 1 in ♂, outer branch more definitely incised than in *cingulata*, but less so than in *hirsuta*; apex of inner branch (fig. 18, b).

Uropod, peduncle longer than wide, inner ramus one-half length of outer ramus.

Up to 13×5 mm., ovigerous ♀♀ from 8 mm. upwards. Horny-yellowish, more or less suffused with minute grey dendritic specks, which are more or less confluent along the sides, mid-dorsal line, and margins of segments; sometimes almost or quite uniform yellowish; legs pale, sometimes with a few speckles, 1st-3rd joints of antennae orange, rest dark slaty-grey, eyes black.

Localities.—Natal: Howick (W. F. P.); Durban, Inchanga, and Scottburgh (K. H. B.); Port Edward, South Coast (Natal Museum).

Distinguished by the very short pleural points, and the speckly

coloration ; the contrast of colour in the antennae is very striking in life, but often fades in alcoholic material.

The exact position of this species was not defined by Budde-Lund. In 1906 (pp. 71, 90) he grouped *hirsuta* and *mina* from South Africa and *pubescens* from New Zealand together, although in 1904 (p. 43) he had already incorporated *pubescens* in *Pseudophiloscia*. In 1908 (p. 290) *Nahia* is instituted for *hirsuta* "and others," but *mina* is not specifically mentioned.

Budde-Lund's description fits the present specimens, and the colour he gives for the antennae leaves no doubt that they should be referred to his species : "ad basin flavescens, ad apicem nigrescentes ; articulorum basis flava."

The original specimens were collected by Drege either in the Cape or Natal.

Philoscia (Setaphora) cingulata n. sp.

(Figs. 16, *o* ; 17, *b* ; 18, *b* ; 19, *b*.)

Closely resembling *mina*, with which it agrees in the shape of the outer branch of pleopod 1 ♂ (fig. 16, *o*), but differing in the colour pattern. Flagellum of antenna 2 a little longer than 5th peduncular joint. Spines on 4th and 5th joints of pereopods 1-3 in ♂ deeply bifurcate, the points entire (fig. 19, *b*).

7 × 3 mm. Pale yellowish, with broad greyish bands across front of head between eyes, and across the pereon and pleon segments, on the latter usually interrupted in the middle line ; antennae pale greyish, legs pale without grey marks ; eyes black.

Localities.—Natal : Port Shepstone (K. H. B., 1912) ; Howick (W. F. P.).

The widely different colour pattern at once separates this form from *mina*. Even in the most strongly suffused examples of the latter species the grey pigment does not form a band across the anterior margin of the 1st pereon segment.

Philoscia (Setaphora) demarcata n. sp.

(Figs. 16, *q* ; 17, *c* ; 18, *a* ; 19, *b*.)

Surface with scattered setae, becoming longer on epimera and on pleon and telson.

Postero-lateral angles of pereon segments 5-7, especially 7, acute. Epimera of segments 2-4 in ♀ demarcated. Pleurae of segments 3-5

acutely produced, but not spreading, projecting portions equal to mid-dorsal length of segments. Telson triangular, apex acute.

Peraeopods 1-3 in ♂, spines on 4th and 5th joints as in *cingulata* (fig. 19, b).

Pleopod 1 in ♂, outer branch apex acute, outer distal margin excised, but not as deeply as in *hirsuta* (fig. 16, q); apex of inner branch (fig. 18, a).

Uropod, greatest width of peduncle nearly equal to length, inner ramus half length of outer ramus.

7 × 3 mm. Brownish-fulvous, with lighter and darker mottling.

Locality.—Natal: Pietermaritzburg (K. H. B., 1917).

This species is at once distinguished from all the other South African species of *Philoscia* by the acute postero-lateral angles of peraeon segments 5-7, and in the ♀ by the demarcated epimera on segments 2-4 (cf. Budde-Lund, 1908, pp. 295, 296).

Subgen. *Nahia* B-L.

1908. *Nahia*. Budde-Lund in Voeltzkow, Reise, ii, p. 290.

Head discrete, frontal margin obsolete. Pleurae small, adpressed. Molar penicil consisting of a single unbranched seta. Apex of inner plate of maxilliped spinose. Uropod as in *Setaphora*.

At present this subgenus contains only the one species, as *mina* is more properly included in *Setaphora*, and *pubescens* (New Zealand) has gone into *Paraphiloscia* Stebb., 1900 (*Pseudophiloscia* B-L., 1904).

Philoscia (*Nahia*) *hirsuta* B-L.

(Figs. 16, j, k, p, v; 18, c; 19, f.)

1906. *Philoscia hirsuta*. Budde-Lund, Deutsch. Südpol. Exp., ix, p. 89, pl. iii, figs. 42-52 (figs. 42 and 43 are transposed).

1908. „ „ *Id.*, in Voeltzkow, Reise, ii, p. 290.

1910. *Nahia* „ Stebbing, Gen. Cat. S. Afr. Crust., p. 442.

1917. *Philoscia warreni*. Collinge, Ann. Nat. Mus., iii, p. 578, pl. xlii, figs. 10-20.

1920. „ „ *Id.*, *ibid.*, iv, p. 477, pl. xxvii, fig. 7.

1922. *Anchiphiloscia karongae*. Stebbing, K. Vet. Handl. Goteb., xxv, p. 6 (non *A. karongae* Stebb., 1908).*

* Stebbing here includes *cunningtoni* as a synonym of *karongae* in spite of Budde-Lund's opinion (1910, p. 17) that the two species belong to two separate

Surface with scattered setules, more numerous and longer laterally, and on pleon segments and telson, hind margins of segments not setulose (fig. 16, *j*).

Postero-lateral angles of peraeon segment 7 quadrate, reaching to about end of pleon segment 4. None of the epimera demarcated in ♀. Pleurae of segments 3-5 very shortly produced, adpressed, scarcely visible in dorsal view, the projecting portions less than half the mid-dorsal length of segments. Telson triangular, dorsally not impressed.

Flagellum of antenna 2 a little longer than 5th joint, its joints subequal or the 1st a little longer than either 2nd or 3rd.

Peraeopods 1-3 in ♂, spines on 4th and 5th joints deeply bifurcate, each branch with a subterminal denticle (fig. 19, *f*).

Pleopod 1 in ♂, outer branch apically acute, outer margin distally excised (fig. 16, *p*); apex of inner branch (fig. 18, *c*).

Uropod, peduncle longer than wide, inner ramus half length of outer.

11 × 5 mm. (Collinge says 14 mm.); ovigerous ♀♀ from 7 mm. upwards. Slaty-grey, mottled and irrorated with lighter, basal joints of antennae always grey, though the basal part of each segment of the peduncle may be pale, legs and uropods more or less suffused, as may be also the outer branches of pleopods 3-5, and sometimes the penis, eyes black.

Localities.—Cape Province: Cape Peninsula and Cape Flats (Budde-Lund and K. H. B.); Houw Hoek (K. H. B.); Franche Kraal, Gans Bay (Stebbing); Bredasdorp (R. F. L.); Swellendam (K. H. B.); Mossel Bay (W. F. P.); Forebay, near Mossel Bay (K. H. B.); Pocaltsdorp (W. F. P.); Wilderness, near George (S. H. H. and C. T.); Knysna (R. F. L.); Keurbooms River (K. H. B.); Addo Bush (J. D.); Port Alfred; Alice (S. H. H.); East London (Collinge); Katberg (Albany Mus.); Grahamstown (Albany Mus.).

Natal: Durban and other localities (Collinge); Inchanga, Pietermaritzburg, and Krantzkop (K. H. B., 1917).

Zululand: M'fongosi (Collinge and W. E. J.).

subgenera: *karongae* to *Setaphora*, being very likely a synonym of *S. suarezi*, and *cunningtoni* to *Aphiloscia*, being possibly a synonym of *A. maculicornis*. See *supra*, p. 242.

Collinge does not describe the 1st pleopod in ♂, but from an examination of my Natal specimens there can be no doubt that *warreni* is a synonym. From the coastal distribution of this species it seems highly probable that Stebbing's specimens from Gans Bay should be referred here.

From the material at hand it appears that ovigerous ♀♀ are found in the Cape from October to March, and in Natal from November to January. I have seen no specimens as large as 14 mm. (unless the uropods be included in this measurement), but the Natal specimens tend to be larger than those from the Cape.

The species is found among dead leaves and humus, and occurs on the margins of salt or brackish vleis (Noordhoek and Zeekoe Vleis, Cape Peninsula, K. H. B.) or estuaries (Keurbooms River, K. H. B.). It does not occur on the upper slopes or top of the Cape Peninsula mountains.

Benthanops subgen. n.

Head discrete, frontal margin obsolete. Pleurae small, adpressed. Molar penicil consisting of a tuft of plumose setae, each arising separately (fig. 16, *c*) (as in *Balloniscus*, Budde-Lund, 1908, p. 289, pl. xvi, fig. 3), not joined together in a common stem as in *P. muscorum*. Apex of inner plate of maxilliped with one spine. Inner 5 spines on outer lobe of maxilla 1 strongly serrate (fig. 16, *f*); the 2 plumose setae on inner lobe elongate. Peduncle of uropod with outer edge channelled. Eye consisting of a single large ocellus.

This subgenus is very close to *Benthana* B-L., 1908, which comprises 4 species from Brazil, Chile, and Peru (Jackson, Proc. Zool. Soc. Lond., 1926, p. 193 *sqq.*), and is characterised by the serrate spines on outer lobe of 1st maxilla. In the subgenus *Benthana* Jackson included also *minima* Dollfus from the Iberian Peninsula. This last species agrees with the typical species of *Benthana*, but has the eyes simple, *i.e.* each eye consists of only a single ocellus. Whether *minima* should be separated on this account is perhaps an open question.

The form here included in a new subgenus agrees with *minima* in the simple eyes, and is separated from the typical species of *Benthana* in the molar penicil; and also the 2nd maxilla which has no apical cleft.

Philoscia (*Benthanops*) *fulva* n. sp.

(Figs. 16, *c, f, r*; 18, *e*; 19, *f*; 20.)

Surface with scattered setules, more noticeable in the young, regularly spaced setules on hind margins of segments.

Postero-lateral angles of segment 7 quadrate. None of the epimera demarcated in ♀. Pleurae of segments 3–5 shortly produced, just visible in dorsal view, projecting portions not more than half mid-dorsal length of segments. Telson broader than long, margins feebly concave, apex narrowly rounded or subacute.

Antenna 2 reaching to middle of 4th peraeon segment, slender, 5th joint equal to 3rd plus 4th, flagellum subequal to 5th, 1st joint longest, 2nd and 3rd subequal.

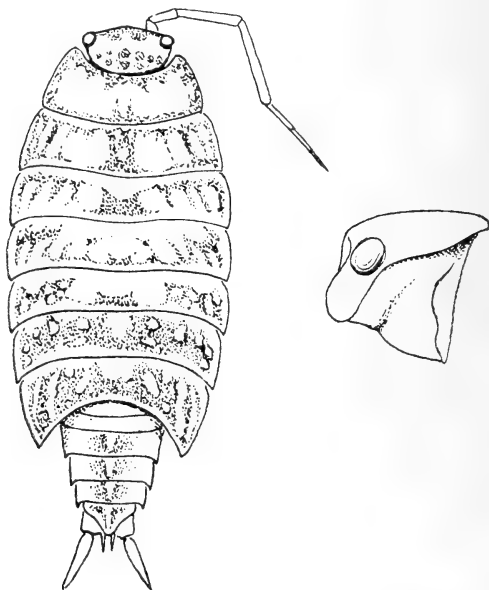


FIG. 20.—*Philoscia* (*Benthanops* subgen. n.) *fulva* n. sp.
Whole animal with lateral view of head.

Maxilla 1, outer plate with 4 + 5 spines, inner spines with fine and close serrations on inner margins.

Maxilliped as in *Benthana* (Jackson, *loc. cit.*, 1926, figs. 136, 147, 159), but with only a small spine on inner plate.

Peraeopods 1–3 in ♂, spines on 4th and 5th joints deeply bifurcate as in *hirsuta* (fig. 19, *f*).

Pleopod 1 in ♂, outer branch apex blunt, outer margin slightly concave (fig. 16, *r*); apex of inner branch (fig. 18, *e*).

Uropod, peduncle with outer edge grooved, outer ramus twice length of peduncle, inner ramus arising from almost same level as outer ramus, about one-third length of outer ramus.

Up to 7 × 2.5 mm. Yellowish-horny, very faintly marbled with

darker fulvous brown, eyes glistening brown. In some specimens there are well-marked dark brown markings on a whitish or yellowish ground colour, eyes dark brown.

Localities.—Cape Province: Table Mt. and other mountains in the Cape Peninsula (K. H. B.); Palmiet River Mts., near Kleinmond (K. H. B.); Zwartberg, Caledon (K. H. B.).

The dark specimens are very much rarer than the ordinary yellowish form, from which they cannot be distinguished morphologically, and appear to be merely melanistic aberrations.

The species occurs under stones and among humus in the bushy or wooded ravines of the mountains; it does not occur at low levels.

Philoscia elongata Dollf.

- 1879. *Philoscia pulchella*. Budde-Lund, Prosp. Crust. Isop. Terr., p. 2 (*sine descr.*).
- 1884. " *elongata*. Dollfus, Bull. Soc. Étud. Sc. Paris, 7me An.
- 1885. " *pulchella*. Budde-Lund, Crust. Isop. Terr., p. 214.
- 1892. " *elongata*. Dollfus, Ann. Soc. Esp. d'Hist. Nat., xxi, p. 186.
- 1895. " " *Id.*, Mem. Soc. Zool. Fr., viii, p. 350.
- 1896. " " *Id.*, Wiss. Mitt. Bosn. Herzog, iv, p. 586.
- 1914. " *pulchella*. Arcangeli, Atti Soc. It. Sc. Nat. Milan, lii, p. 479.
- 1923. " *elongata*. *Id.*, Bol. Mus. Zool. Anat. Torino, xxxviii, n.s., No. 3, pp. 1-7, pl. i.*
- 1924. " " *Id.*, Trabaja. Mus. Cienc. Nat. Barcelona, iv, No. 12, p. 24.
- 1925. " " *Id.*, Abh. Senckenb. Ges., xxxix, p. 136.
- 1926. " " *Id.*, Senckenbergiana, viii, p. 268.
- 1926. " " *Id.*, Atti Mus. Civ. St. Nat. Trieste, xi, p. 42.

This Mediterranean (South Europe and North Africa) species was recorded from Cape Town by Dollfus (1895).

* In vol. xxxviii, 1923, papers 1-3 are numbered vol. "xxviii," which is evidently a *laps. typ.*, as papers 4-14 are correctly numbered as belonging to vol. xxxviii. Arcangeli in 1926 (Trieste), p. 58, quotes the number "xxviii" in his bibliography.

The original description is inaccessible to me, and Budde-Lund's 1885 description is insufficient to place the species in any definite subgenus (as is probably also the original description).

One of the characters which separates it from *muscorum* and all the South African species is the length of pleon segments 1 and 2, which are scarcely shorter than the other pleon segments (Budde-Lund, 1885, and Arcangeli, 1923, pl. i, fig. 5); in fact Arcangeli's figure shows the first segment (σ) as twice the length of any of the others. The pleurae of segments 3-5 are very small, adpressed. Sides of telson straight. Peduncle of uropod externally sulcate (Budde-Lund).

Arcangeli (1923) describes and figures a modification in the 1st peraeopod and the *fifth* pleopod of the σ , which he suggests may be assumed only at the period of copulation; and he expresses a warning against using these modifications as specific characters.

The 5th joint of peraeopod 1 is ovately expanded, almost sub-circular, in the left peraeopod, but less expanded in the right; the 6th joint also is somewhat more lanceolate in the left than in the right. A similar but less marked modification occurs in the 2nd peraeopod. The figure shows a few large spines on the inner margin of the 4th and 5th joints, not the thick brush of spines which is usual in the σ . Expansion of the 5th joint of peraeopod 1 in σ occurs also in *variegata* Dollf. (see van Name, Amer. Mus. Novitat., No. 206, p. 11, figs. 19, 20, 1926; and Arcangeli, Boll. Lab. Zool. Gen. Portici, xxv, p. 18, fig. v, 4, 1930), and according to van Name in *muscorum*; in the latter species I have not found any expansion in English examples.

The most remarkable modification is the extreme extension of the outer ramus of the 5th pleopod into a long slender process, which is channelled on its inner margin, and protrudes far beyond the telsonic apex, and even beyond the apices of the uropods.

Arcangeli (1925, Monit. Zool. Ital., xxxvi, p. 105) has recorded a local race of this species, which exhibits protandrous hermaphroditism and also parthenogenesis. As in *Rhyscotus* (see p. 287, *infra*) the males retain the external genitalia during the female phase. Normal females exist alongside the hermaphrodites. The latter only function as males during or at the end of their first year of life; they fertilise the genuine females of the same age. The following year the testes degenerate and the ovaries mature. It seems that the young males cannot fertilise the older and larger genuine females, and the evidence goes to show that the latter are parthenogenetic. The fertilised eggs of the young females develop into protandrous hermaphrodites,

while the large females produce genuine females parthenogenetically (summary from Jackson, Quart. Journ. Microsc. Sci., lxxi, 1928).

Gen. PORCELLIO Latr.

1804. *Porcellio*. Latreille, Hist. Nat. Crust. Inst., vii, p. 45.
 1885. „ Budde-Lund, Crust. Isop. Terr., p. 82.
 1898. „ Sars, Crust. Norw., ii, p. 176.
 1907. „ Verhoeff, SB. Ges. Naturf. Fr. Berlin, p. 229
 (subgenera).
 1908. „ Budde-Lund in Voeltzkow, Reise, ii, p. 280
 (subgenera).

Body smooth, granulate, or tuberculate. Head discrete, lateral lobes well developed, frontal lobe usually projecting. Pleon not much narrower than peraeon, pleurae well developed. Telson apically produced.

Antenna 2, flagellum 2-jointed, the two joints subequal. Mandible with several penicils between the secondary cutting plate and the molar penicil, which consists of a tuft of plumose setae.* Peraeopods 1-3 and sometimes also 7 sexually dimorphic. Outer branches of pleopods 1 and 2, or 1-5, with pseudotracheae. Peduncle of uropod externally grooved or excised, outer ramus often larger in ♂ than in ♀.

This large genus has been subdivided into a number of subgenera. Budde-Lund (1908) lists 21 subgenera, divided into two groups according to the spines on outer lobe of maxilla 1, but not otherwise defined except by their respective genotypes. Verhoeff, however, had previously subdivided the genus, and irrespective of the character selected by Budde-Lund for his two major groups. Verhoeff, *e.g.*, places *hoffmanseggii*, *rathkei*, *scaber*, and *obsoletus*, inter alia, in his *Euporcellio*, whereas Budde-Lund makes each of these species the type of a subgenus. Verhoeff indicates no genotypes, but places *laevis* as the first species of his *Mesoporcellio*. This latter name therefore may be definitely regarded as coinciding with and antedating Budde-Lund's *Gymnoderma*, genotype *laevis*.

The sexual difference in the 7th peraeopod is in the shape and size of certain of the joints; in the 1st-3rd peraeopods it lies in the increased number of spines on the anterior and lower surfaces of the

* Sars' figure (1898 pl. lxxvii) is not quite correct. The molar penicil consists of several plumose setae each arising separately, as I have checked by examination of Norwegian and other examples of *scaber*.

4th and 5th joints and the minute structure of these spines (*cf.* Wahrberg, 1922).

The armature of spines on the anterior peraeopods in the ♂ is regarded by Verhoeff as a cleansing apparatus (*Putzapparat*) and the term is accepted by Wahrberg (1922, pp. 94, 153). The term seems to be incorrect, for it is not clear why the ♂ requires to be cleaner than the ♀, or requires a stronger brush of spines to effect the same purpose as the comparatively few spines in the ♀. It seems, on the other hand, clear that this brush of spines on the anterior peraeopods of the ♂ is for the purpose of securing a grip on the ♀ during copulation, and Verhoeff would have been more correct in using the term "*Haftapparat*."

Porcellio (Porcellio) scaber Latr.

(Fig. 21, *a-c.*)

- | | | |
|-------|--------------------------|-----------------------------------------------------------------------|
| 1804. | <i>Porcellio scaber.</i> | Latreille, <i>loc. cit.</i> , p. 45. |
| 1885. | " " | Budde-Lund, <i>loc. cit.</i> , p. 129. |
| 1895. | " " | Dollfus, <i>Mem. Soc. Zool. Fr.</i> , viii, p. 349. |
| 1898. | " " | Sars, <i>loc. cit.</i> , p. 176, pl. lxxvii. |
| 1906. | " " | Webb and Sillem, <i>Brit. Woodlice</i> , p. 32, fig. 47 and pl. xiii. |
| 1906. | " " | Budde-Lund, <i>Deutsch. Südpol. Exp.</i> , ix, p. 88. |
| 1909. | " " | <i>Id.</i> , in Schultze, <i>Reise</i> , ii, p. 58. |
| 1910. | " " | Stebbing, <i>Gen. Cat. S. Afr. Crust.</i> , p. 440. |
| 1922. | " " | Wahrberg, <i>Ark. Zool.</i> , xv, p. 4, fig. 1. |

Surface with transverse rows of rounded tubercles on head and peraeon segments, and on posterior margins of pleon segments. Frontal and lateral lobes on head equally prominent. Telson as long as broad, apex acute, dorsally slightly grooved.

Flagellum of antenna 2 subequal to 5th peduncular joint, its two joints subequal. Four of the inner spines on outer lobe of maxilla 1 bifid. Peraeopod 7 not differing in the two sexes. Peraeopods 1-4 in ♂ with thick brush of spines (fig. 21, *c*). Dactylar seta on all peraeopods simple, acute. Pseudotracheae on pleopods 1 and 2.

Up to 16 × 7.5 mm. Slaty-grey, uniform or variously mottled.

Localities.—Cape Province: Cape Town (Dollfus and S.A. Mus.); Cape Flats (Budde-Lund).

Distribution.—Cosmopolitan. It occurs on the islands of St. Paul and New Amsterdam (Indian Ocean), and St. Helena (Budde-Lund). The South African Museum has examples from Tristan d'Acunha.

In and around Cape Town this species seems to be far less common than *laevis*.

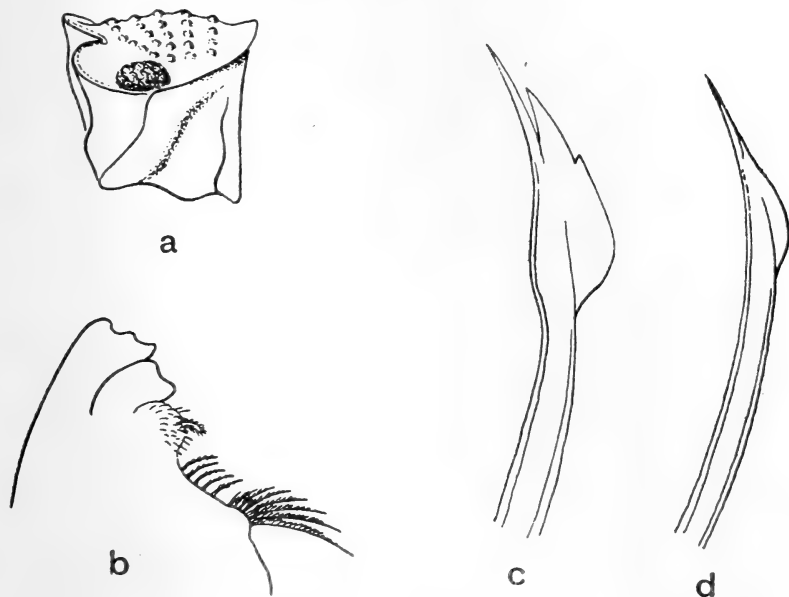


FIG. 21.—*Porcellio*. a, b, lateral view of head, and apex of mandible of *scaber*; c, d, spines from peraeopod 1 ♂ of *scaber* and *laevis* respectively.

Porcellio (Mesoporcellio) laevis Latr.

(Fig. 21, d.)

1804. *Porcellio laevis*. Latreille, *loc. cit.*, p. 46.
 1885. „ „ Budde-Lund, *loc. cit.*, p. 138.
 1898. „ „ Sars, *loc. cit.*, p. 181, pl. lxxix, fig. 2
 (synonyms).
 1906. „ „ Webb and Sillem, Brit. Woodlice, p. 35,
 fig. 51 and pl. xvii.
 1906. „ „ Budde-Lund, Deutsch. Südpol. Exp., ix,
 p. 88.
 1922. „ „ Wahrberg, Ark. Zool., xv, p. 182, figs. 9, 58.

Surface smooth or very feebly tuberculate, chiefly on posterior margins of pleon segments. Frontal lobe not quite so prominent as the lateral lobes. Telson broader than long, apex acute, dorsally grooved.

Flagellum of antenna 2 less than 5th peduncular joint, its 1st joint

slightly longer than 2nd. All spines on outer lobe of maxilla 1 entire. Peraeopods 1-4 in ♂ with thick brush of spines (fig. 21, *d*). Peraeopod 7 not sexually different. Dactylar seta on all peraeopods simple, acute. Pseudotracheae on pleopods 1 and 2.

Up to 20×10 mm. Slaty-grey, with a few faint lighter markings on either side of the median line.

Localities.—Cape Province: Cape Town and environs (R. M. L., K. H. B.); Somerset West (A. J. H.).

Distribution.—Cosmopolitan. Has been recorded from St. Helena (Budde-Lund).

This species is very common in gardens in Cape Town and suburbs, and in many areas seems to have almost entirely superseded *scaber*; but apparently has not spread further than to Somerset West.

Gen. PORCELLIONIDES Miers.

- | | | |
|-------|-------------------------|------------------------------------------------------------------------|
| 1877. | <i>Porcellionides</i> . | Miers, Proc. Zool. Soc. Lond., pp. 668, 676. |
| 1879. | <i>Metoponorthus</i> . | Budde-Lund, Prosp. Crust. Isop. Terr., p. 4. |
| 1885. | " | <i>Id.</i> , Crust. Isop. Terr., pp. 76, 161. |
| 1898. | " | Sars, Crust. Norw., ii, p. 183. |
| 1908. | " | Budde-Lund in Voeltzkow, Reise, ii, p. 285. |
| 1911. | <i>Porcellionides</i> . | Stebbing, Rec. Ind. Mus., vi, p. 188. |
| 1928. | " | Jackson, Proc. Zool. Soc. Lond., 1928, i, p. 584 (morphology of head). |

Body smooth or granulate. Integument thin, not strongly chitinised or calcified. Head discrete, lateral lobes small and frontal lobe obsolete, frontal line continued round the lateral lobes and meeting the marginal line below the eye. Pleon abruptly narrower than peraeon, pleurae moderate or small. Telson triangular, not produced.

Antenna 2 flagellum 2-jointed, 1st joint slightly longer than 2nd. Mandible with several penicils between secondary cutting plate and the molar penicil, which consists of a tuft of plumose setae, with or without a short common stem. Peraeopods 1-3 in ♂ more strongly spinose than in ♀. Outer branches of pleopods 1 and 2, sometimes also 3, sometimes 1-5, with pseudotracheae. Peduncle of uropod externally grooved or excised.

Stebbing gives the reasons why *Porcellionides* must displace *Metoponorthus*.

The genus is represented in South Africa only by an imported cosmopolitan species.

Porcellionides pruinosus (Brdt.).

(Fig. 22.)

1833. *Porcellio pruinosus*. Brandt, Consp. Onisc., pp. 181 (19),
188 (26).
1885. *Metoponorthus* „ Budde-Lund, Crust. Isop. Terr., p. 169.
1895. „ „ Dollfus, Mem. Soc. Zool. Fr., viii,
p. 350.
1898. „ „ Sars, Crust. Norw., ii, p. 184, pl. lxxx,
fig. 2.
1906. „ „ Webb and Sillem, Brit. Woodlice, p. 37,
fig. 53 and pl. xix.
1909. „ „ Budde-Lund in Schultze, Reise, ii, p. 58.
1909. „ „ *Id.*, Res. Swed. Zool. Exp. White Nile,
iii, Terr. Isop., p. 4.
1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 440.
1911. *Porcellionides* „ *Id.*, Rec. Ind. Mus., vi, p. 189.
1920. „ „ Collinge, Ann. Nat. Mus., iv, p. 479,
pl. xxix, figs. 39–47.
1922. „ „ Richardson, Voy. Rothschild Ethiop.,
i, p. 33.
1922. *Metoponorthus* „ Wahrberg, Ark. Zool., xv, pp. 6, 27,
148, figs. 2, 8, 9, 51.
1924. „ „ Panning, Beitr. Kennt. Land. Süsswas-
serf. S.W. Afr., ii, p. 176.
1931. „ „ Brian, Rev. Suisse Zool., xxxviii,
p. 439, figs. 32–38 (var. *africana*).

Surface smooth. Faint indications of transverse series of granules or very low tubercles on head and peraeon segments. Epistome with a V-shaped raised line (in Jackson's terminology, 1928, this V separates the postfrons from the profrons).

Antenna 2, 1st joint of flagellum slightly longer than 2nd.

Peraeopods, distal margin of 3rd joint, distal and inner margins of 4th and 5th joints, with close-set short stout spines in all peraeopods in ♀; in the ♂ this marginal armature is absent on the inner margins of 4th and 5th joints in peraeopods 1–3, which carry instead a thick patch of spines.

Pleopod 1 in ♂, apex of inner branch with a few setules, a row of minute granules along inner margin.

Up to 11 × 5 mm. Slaty-grey, faintly mottled, margins of peraeon

and pleon segments sometimes pale, legs and antennae greyish with white markings. The blue-grey colour of live specimens is due to a bloom which is easily rubbed off; preserved specimens fade to a reddish-brown colour.

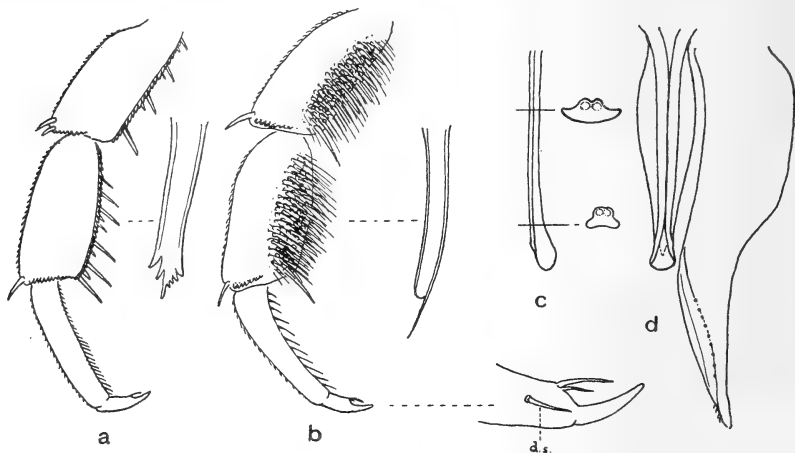


FIG. 22.—*Porcellionides pruinosus* (Brdt.). *a, b*, Distal joints of peraeopod 1 ♀ and ♂ respectively, with spines and dactylar seta (d.s.) further enlarged; *c*, profile view of penis, ventral surface to left; *d*, penis and stylet of pleopod 1 ♂, dorsal view, with cross-section of penis across middle and near apex (in the cross-sections the dorsal surface is uppermost, and the vasa deferentia are represented by dotted circles).

Localities.—Cape Province: Cape Town (Dollfus, W. F. P., and K. H. B.); Cape Flats (Budde-Lund); French Hoek (W. F. P.); Clanwilliam (R. M. L.); Zak River (S.A. Mus.); Steinkopf (Budde-Lund); Bowiesdorp (K. H. B.); Graaf Reinet and Beaufort West (S. H. H.); Lovedale (S. H. H.); Avontuur (W. F. P.); Port Elizabeth (S.A. Mus.); Port St. Johns (S.A. Mus.); Grahamstown (S.A. Mus. and Albany Mus.); Fort Brown (Albany Mus.); Swellendam and Riversdale (K. H. B.); Kimberley (J. H. Power); Richmond (C. T. and L. D. B.).

Natal: Pietermaritzburg (Collinge and K. H. B.); Durban (Collinge and K. H. B.); M'fongosi, Zululand (S.A. Mus.).

Portuguese East Africa: Masiene (R. F. L.).

Transvaal: Hebron and Hammans Kraal (Dollfus); Sabie Game Reserve (E. L. G.); Johannesburg (S.A. Mus.).

Rhodesia : Bulawayo and Salisbury (R. W. E. T.).

Damaraland : Swakopmund, Neudamm, Windkoek, Okahandja, Omaruru (Panning); Outjo (R. F. L. and A. J. H.); Otjituo (R. W. E. T.).

Angola : Vila da Ponte, Kubango R. (Brian).

Distribution.—Cosmopolitan.

This species is only found in the neighbourhood of human habitations.

The differences noted by Collinge are not constant, even in Natal examples, and cannot be used to characterise a local race. I have compared South African specimens with specimens from Norway (*ex* G. O. Sars) and South England. For example, the spines on outer lobe of maxilla 1 are bifid in European specimens, and the outer apex of inner lobe of maxilla 1 is acutely pointed in South African specimens. The inner branch of pleopod 1 in ♂ corresponds exactly with that of European examples.

Gen. NIAMBIA B-L.

- 1904. *Niambia*. Budde-Lund, Rev. Crust. Isop. Terr., p. 37.
- 1908. „ *Id.*, in Voeltzkow, Reise, ii, p. 280 (also p. 295, epimeral sutures).
- 1909, „ *Id.*, in Schultze, Reise, ii, p. 59.
- 1910. „ *Id.*, Sjöstedt, Kilimandjaro-Meru Exp., iii, 21, pp. 8, 9, 10.
- 1924. *Thomsenia*. Panning, Beitr. Kennt. Land. Süßwasserf. S.W. Afr., vol. ii, p. 173.

Surface more or less densely covered with setae or scale-spines, which are usually clavate or battledore-shaped, most numerous laterally and on margins of segments and on telson.

Head discrete. Eyes small or moderate, ocelli less than 20.

Epimeral sutures present on segments 2-4 in ♀. Pleurae of pleon segments 3-5 well developed. Telson short, triangular, apex more or less acute, dorsally impressed.

Antenna 2 short, flagellum 2-jointed, 2nd joint 2-3 times as long as 1st. Mandible with single free penicil, molar penicil consisting of several setae on a very short stem (*i.e.* a single branched seta). Maxilla 1, outer lobe with the 4 inner spines either apically bifid, usually feebly so, or simple (*Niambia* s.s.), or strongly serrate (subgen. *Manibia*), inner lobe with 2 unequal plumose setae. Maxilliped, inner plate with 1 spine, and 2 denticles on outer distal corner.

Peraeopods 1-3 in ♂ with thick brush of strong spines on lower and anterior surfaces of 4th and 5th joints. Dactylar seta in all peraeopods apically acute. Peraeopod 7 not dimorphic.

Outer branches of all pleopods with rudimentary pseudotracheae.

Uropod, peduncle short, externally evenly convex, *i.e.* elliptical in cross-section, outer ramus stout.

There appears to me to be considerable doubt as to the validity of *Thomsenia*, even if it be admitted only as a subgenus. Some of the characters relied upon by Panning as differential are, however, common to *Niambia*, *e.g.* the maxilliped and inner lobe of maxilla 1. The inner spines of the outer lobe of maxilla 1 are often so feebly bifid, some of them actually entire, in typical *Niambia*, that this character is valueless even for specific purposes. The very slender spine (No. 4) which leans up against the 3 strong outer spines, as shown in Panning's figure, I have not found in any of the numerous examples of *Niambia* examined, including several specimens of *griseo-flavus*, a species which I believe may be identical with Panning's species (see p. 264). As for the recurved integumentary spinules, they are in lateral view indistinguishable from the ordinary squamose spines which cover the surface in all species of *Niambia*. In view of these doubts *Thomsenia* cannot be accepted otherwise than as a subgenus. Even the one character which might be used to separate a subgenus, *viz.* the shortness of the outer ramus of the uropod, is ruled out by *flavescens* where the peduncle and outer ramus are subequal in length, thus forming a transition.

The genus has hitherto been known only from the south-western portions (Port Elizabeth westwards) of South Africa, and northwards to the Congo, and possibly Senegal. In 1906 (p. 89) Budde-Lund said he knew of two undescribed species from the Cape and Natal, but in 1909 he described no species from Natal, unless he regarded Port Elizabeth (*hirsuta*) as being in Natal. Collinge (1917, p. 568) mentions having specimens of this genus, with a (?), in the collection in his hands, but likewise did not describe any species from Natal. There are none in the South African Museum collection collected by Dr. Purcell; nor did I find any myself in that region. It is interesting therefore to find that there are two species from Portuguese East Africa and Rhodesia which are very closely related to the typical *Niambia*, but for which I consider it advisable to institute a new subgenus (see fig. 39).

Key to the South African species.

- I. Inner spines of outer lobe of maxilla 1 more or less bifid, sometimes very feebly so, or even entire (fig. 24, a) Subg. *Niambia*.
 - A. Antenna 2, 4th joint subequal to, or very slightly longer than 3rd.
 1. Pleura of segment 5 extending to or nearly to, or a little beyond, telsonic apex.
 - a. Outer ramus of uropod longer than peduncle.
 - i. Rather strongly granulate. Apex of outer branch of pleopod 1 ♂ acute *squamata* (Congo).
 - ii. Feebly granulate. Apex of outer branch of pleopod 1 ♂ excised, bifid *truncata*.
 - b. Outer ramus of uropod equal to peduncle. Apex of outer branch of pleopod 1 blunt *flavescens*.
 - c. Outer ramus of uropod shorter than peduncle. Apex of outer branch of pleopod 1 blunt *damarensis*, *griseo-flavus*.
 2. Pleura of segment 5 not nearly reaching telsonic apex.
 - a. Ocelli 9 *pallida*.
 - b. Ocelli 14 *modesta*.
 - B. Antenna 2, 4th joint distinctly longer than 3rd.
 1. Outer branch of pleopod 1 cordiform. Telson much shorter than broad.
 - a. Narrow. Outer branch of pleopod 1 ♂ with sinuous outer margin, without projection *angusta*.
 - b. Broader. Outer branch of pleopod 1 ♂ with a projection on outer margin.
 - i. Ocelli 12-16. Antenna 2 reaching end of peraeon segment 2 *capensis*.
 - ii. Ocelli 8-9. Antenna 2 reaching end of peraeon segment 1 *formicarum*.
 2. Outer branch of pleopod 1 longer than broad, subtriangular, outer margin deeply excised. Telson nearly as long as broad *longicauda*.
 - II. Inner spines of outer lobe of maxilla 1 strongly serrate (fig. 24, b) subg. *Manibia*.
 - A. Broad. Ocelli 10 *lata*.
 - B. Narrower. Ocelli 6 *microps*.

Niambia squamata (B-L.).

(Fig. 23, i.)

1885. *Leptotrichus squamatus*. Budde-Lund, Crust. Isop. Terr., p. 196.
1904. *Niambia squamata*. *Id.*, Rev. Crust. Isop. Terr., p. 37.
1909. " " *Id.*, Schultze, Reise, ii, p. 60, pl. vi, figs. 1-3.
1910. " " Stebbing, Gen. Cat. S. Afr. Crust., p. 441.
1920. " " van Name, Bull. Amer. Mus. Nat. Hist., xliii, p. 102, figs. 122-126.

(? *Non* Panning, 1924, see *modesta*, infra.)

Surface minutely but rather strongly granulate.

Eyes small, ocelli 16 (Budde-Lund), "few" (van Name).

Projecting portions of the pleurae (as indicated on fig. 24) twice, or nearly twice, mid-dorsal length of segments, those of segment 5 extending almost to level of telsonic apex. Telson with sides concave, apex acute, dorsally impressed.

Antenna 2 a little longer than one-third body length (Budde-Lund), reaching to middle of 1st pereopod segment (van Name's figures), 3rd and 4th joints subequal.

Pleopod 1, outer branch about as broad as long, or rather broader, in ♂ cordiform, apex acute, outer margin slightly sinuous (Budde-Lund and van Name); in ♀ proportionately broader, outer margin concave near apex (van Name).

Uropod, outer ramus longer than peduncle.

7.5 × 4.5 mm. Slaty-grey, with paler markings laterally.

Localities.—Landana and Chinchoxo, Portuguese Congo (Budde-Lund); Benin (Budde-Lund MSS.); (?) Senegal (Dollfus); Zambi, Congo mouth, Belgian Congo (van Name).

This species is not South African, but is included to make the account of the genus complete. Panning was himself not certain of the identity of his specimens with *squamata*, and it seems far more likely that they should be referred to one of the truly South African species.

Niambia truncata (Brdt.).

(Fig. 23, *a*, *b*.)

- | | | |
|-------|-------------------------------------------------------|-----------------------------------------------------------------|
| 1833. | <i>Porcellio truncatus</i> . | Brandt, Consp. Oniscid., pp. 19, 28. |
| 1885. | <i>Leptotrichus</i> „ | Budde-Lund, Crust. Isop. Terr., p. 195. |
| 1904. | <i>Niambia truncata</i> . | <i>Id.</i> , Rev. Crust. Isop. Terr., p. 37. |
| 1906. | „ „ | <i>Id.</i> , Deutsch. Südpol. Exp., ix, p. 89. |
| 1909. | „ „ | <i>Id.</i> , in Schultze, Reise, ii, p. 60, pl. vi, figs. 4–14. |
| 1909. | „ <i>brunnea</i> . | <i>Id.</i> , <i>ibid.</i> , p. 61, pl. vi, figs. 15–25. |
| 1909. | „ <i>hirsuta</i> . | <i>Id.</i> , <i>ibid.</i> , p. 62, pl. vi, figs. 29–31. |
| 1910. | „ <i>truncata</i> , <i>brunnea</i> , <i>hirsuta</i> . | Stebbing, Gen. Cat. S. Afr. Crust., pp. 441, 442. |
| 1924. | „ „ | Panning, Beitr. Kennt. Land. Süßwasserf. S.W.A., ii, p. 193. |

Surface with faint indications of granules.

Eyes with 12–16 ocelli (Budde-Lund: *truncata* 10, *brunnea* 16).

Projecting portions of pleurae $1\frac{1}{2}$ –2 times longer than mid-dorsal length of segments; of 5 extending nearly to level of telsonic apex.

Telson, sides concave, apex acute, slightly impressed dorsally.

Antenna 2 reaching to, or a little beyond, end of peraeon segment 1, 4th joint a little longer than 3rd.

Peraeopods 1–3 in ♂ strongly fringed on lower and anterior surfaces with spines, most of which are apically bifid, some multifid; in ♀ the spines are less numerous, and all are of the latter type.

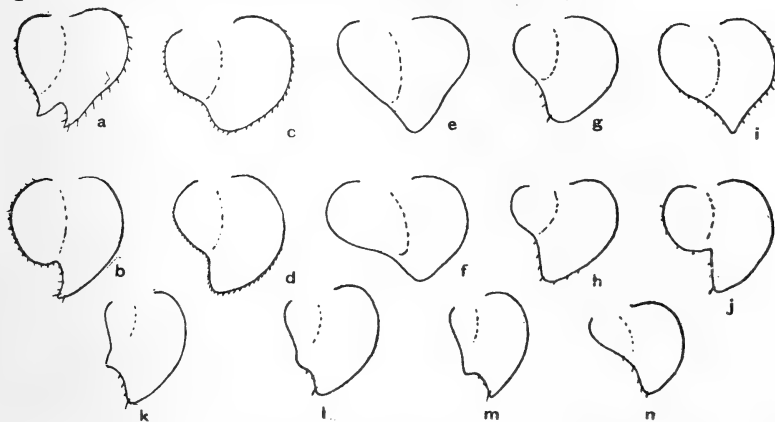


FIG. 23.—*Niambia*. Outer ramus of pleopod 1 of: a, b, *truncata* ♂ and ♀; c, d, *flavescens* ♂ and ♀; e, f, *griseo-flavus* ♂ and ♀; g, h, *angusta* ♂ and ♀; i, *squamata* ♂ (after Budde-Lund); j, *lata* ♀; k–m, *capensis* ♂ (three forms); n, *capensis* ♀. (In all cases the inner margin to right.)

Pleopod 1, outer branch about as broad as long, in ♂ outer margin with a triangular projection near apex (or apex can be described as having a semicircular or angular excision); in ♀ outer margin angularly incised.

Uropod, outer ramus longer than peduncle.

Up to 16×8 mm. Slaty-grey, with lighter mottling on head and peraeon, telson and each pleon segment with 2 small pale dots, often inconspicuous or absent, antennae grey, legs pale, eyes black.

Localities.—Cape Province: Cape Town and Simonstown (Budde-Lund, also R. M. L., K. H. B.); Port Elizabeth (Budde-Lund: *truncata* and *hirsuta*); Kamaggas and Steinkopf (Budde-Lund: *brunnea*); Faure (W. F. P.); Saldanha Bay (K. H. B.); Vredenburg and Clanwilliam (S. A. Mus.); Garies and Kamieskroon (A. J. H. and R. F. L.); Lilyfontein (K. H. B.); Tulbagh (W. F. P.); Steinthal, Tulbagh (K. H. B.). Damaraland: Walvis Bay (Budde-Lund); Okahandja (Panning).

There is little doubt that *brunnea* is synonymous. A specimen in the Budde-Lund collection in the British Museum labelled *brunnea* is nearly uniform slaty-grey. Specimens which have been long in alcohol fade to a pale straw or fulvous colour.

Of the numerous specimens examined I have not found one with the number of ocelli typical for *truncata* (10); the number varies irrespective of locality between 12 and 16.

I am inclined to regard *hirsuta* as a young *truncata*. The outer branch of pleopod 1 (labelled as that of ♀ in Budde-Lund's figure 31, but obviously a typ. laps.) is exactly like that of *truncata*. Budde-Lund recorded both species from Port Elizabeth; in fact, the specimens of both species were collected by Dr. Brauns on the same day, and it is highly probable that they were found actually together. The young of *truncata* (3-5 mm.) frequently have a few long setae on the epimera, but these are usually lost in specimens as long as 7 mm. Budde-Lund does not indicate them in his figure 30. As mentioned below, the antennae are relatively longer in juveniles.

The following growth-changes take place. In juveniles taken from the brood-pouch the telson is bluntly triangular, the sides slightly convex, and projects very much beyond the pleurae of 5th pleon segment. In specimens about 3.5 mm. in length the telson has straight sides and the apex still projects beyond the 5th pleurae. At about 5 mm. the telson has assumed its adult form.

The 2nd antennae in young specimens are proportionately longer than in the adult, and the clavate setae are far more numerous and prominent.

The outer branch of pleopod 1 in young specimens (3.5 mm.) of both sexes resembles that of adult *capensis*. In the ♂ the projection on the middle of outer margin gradually shifts distally. Consequently it is difficult to separate young specimens of this species from *capensis*, unless they are caught in association with the adults, though they are usually paler in colour and lack the lateral pale marks on the peraeon.

This species is confined to the lower levels and does not ascend the upper slopes of the mountains.

Niambia flavescens Brnrd.

(Fig. 23, c, d.)

1924. *Niambia flavescens*. Barnard, Ann. S. Afr. Mus., xx, p. 233, fig. 2.

Surface closely and distinctly granulate.

Lateral lobes of head rather better developed and more prominent than in other species. Eyes small, ocelli 10.

Projecting portions of pleurae about $1\frac{1}{2}$ times mid-dorsal length of segments; 5th extending at least to level of telsonic apex, usually a little beyond. Telson very short, sides concave, apex acute, dorsally impressed.

Antenna 2 reaching to end of peraeon segment 1, 4th joint a little longer than 3rd, 5th a little longer than 4th, flagellum a trifle shorter than 5th, its 2nd joint twice length of 1st.

Peraeopods 1-3 in ♂ as in *truncata*.

Pleopod 1, outer branch about as broad as long, outer margin incised, more deeply so in ♀ than in ♂.

Uropod, outer ramus equal to peduncle.

8 × 3 mm. Pale slaty-grey, with pale yellowish markings, antennae and legs pale.

Localities.—Ovamboland: several localities (Barnard), as far north as Namakunde on the boundary line of Angola.

Niambia damarensis (Pann.).

1924. *Thomsenia damarensis*. Panning, Beitr. Kennt. Land. Süßwasserf. S.W.A., ii, p. 173, fig. 1.

Surface with regularly spaced minute backwardly directed spines.

Eyes very small, number of ocelli ?.

Projecting portions of pleurae twice mid-dorsal length of segments; 5 extending beyond level of telsonic apex. Telson very short, sides concave, apex acute.

Antenna 2 very short, scarcely reaching end of peraeon segment 1, 3rd and 4th joints subequal, 5th $1\frac{1}{2}$ times as long, flagellum slightly shorter than 5th, its 1st joint slightly shorter than 2nd.

Peraeopod 1 with thick brush of spines on 4th and 5th joints.

Pleopods ?.

Uropod, outer ramus shorter than peduncle.

10 × 5.3 mm. Brownish yellow with lighter markings.

Locality.—Damaraland: 50 km. south of Waterberg (Panning).

The above characters are taken from Panning's description. It is not clear what the words "Die Analfüsse sind . . . kaum länger als das Telson" mean; unless the *width* of the telson is intended. The figure shows the uropods slightly shorter than the width, and much longer than the length of the telson. The description does

not mention the pleopods. The original specimens should be re-examined.

Niambia griseo-flavus Brnrd.

(Fig. 23, e, f.)

1924. *Niambia* (?) *griseo-flavus*. Barnard, Ann. S. Afr. Mus., vol. xx, p. 234, fig. 3.

Surface minutely granulate.

Eyes small, ocelli 10.

Projecting portions of pleurae twice mid-dorsal length of segments, 5 projecting beyond level of telsonic apex. Telson very short, sides concave, apex acute, dorsally impressed.

Antenna 2 short, reaching to or almost to end of peraeon segment 1, 3rd and 4th joints subequal, 5th a little longer, flagellum shorter than 5th, its 2nd joint twice length of 1st.

Peraeopods 1-3 in ♂ as in *truncata*.

Pleopod 1, outer branch about as broad as long in ♂, broader in ♀, cordiform, outer margin slightly sinuous, more so in ♀ than in ♂.

Uropod, outer ramus shorter than peduncle.

10 × 3.5 mm. Pale slaty-grey, with pale yellow markings, the yellow colour sometimes predominating, antennae and legs pale, uropods more or less suffused.

Localities.—Ovamboland: Andoni (Barnard).

Damaraland: Namutoni (K.H.B.); Otjituo (R.W.E.T.).

I think it very probable that these specimens are really Panning's species *damarensis*, but as the pleopods of the latter are not described, and there are other uncertainties (see p. 263), I keep the two forms separate. The very slender spine on the outer lobe of maxilla 1 is not present in this species, of which several examples have been specially examined in this respect; moreover, the normal number of the inner series of spines appears to be only 4, though in one case 5 were found.

Niambia pallida B-L.

1909. *Niambia pallida*. Budde-Lund in Schultze, Reise, ii, p. 61, pl. vi, figs. 26-28.

1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 441.

Eyes small, ocelli 14.

Pleurae of pleon segment 5 much shorter than telson, which is apically impressed.

Antenna 2 equal to two-fifths body length, 4th joint slightly longer than 3rd.

Pleopod 1, outer branch broader than long, in ♂ apex blunt, outer margin slightly incised near apex, in ♀ outer margin sharply incised about in middle (cf. fig. 23, *d* of *flavescens*).

8-10 × 3-4 mm. Pale grey, mottled with whitish laterally.

Localities.—Cape Province : Steinkopf (Budde-Lund).

Great Namaqualand : Kubub (near Lüderitzbucht) and Possession Island (Budde-Lund).

Niambia modesta B-L.

1909. *Niambia modesta*. Budde-Lund in Schultze, Reise, ii, p. 62, figs. 32-34.

1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 442.

1924. „ „ Panning, Beitr. Kennt. Land. Süßwasserf. S.W.A., ii, p. 173.

Eyes small, ocelli 9.

“Epistome with the bulbous frons produced” (Budde-Lund).

Pleurae of pleon segment 5 much shorter than telson, which is apically impressed.

Antenna 2 scarcely exceeding one-third body length, 3rd and 4th joints subequal.

Pleopod 1, outer branch in ♂ and ♀ as in *pallida*.

6 × 2.5 mm. Pale grey, subunicolourous.

Localities.—Damaraland : Grootfontein (Budde-Lund).

Great Namaqualand : Lüderitzbucht, Kuibis, and Seeheim (Panning).

It is probable that this form will prove synonymous with *pallida*. Kubub, whence the latter was recorded, lies between Lüderitzbucht and Kuibis. The descriptions of the two species disclose no essential difference, unless it be in the epistome and frons. In the absence of comparative figures it is impossible to say how far this is merely a verbal difference.

Niambia angusta B-L.

(Fig. 23, *g*, *h*.)

1909. *Niambia angusta*. Budde-Lund in Schultze, Reise, ii, p. 63, pl. vi, figs. 35-37.

1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 442.

1924. „ „ Panning, Beitr. Kennt. Land. Süßwasserf. S.W.A., ii, p. 173.

Surface with very faint indications of granules.

Eyes with 12-14 ocelli.

Projecting portions of pleurae about as long as mid-dorsal length of segments; of 5 extending to level of about half telsonic length.

Telson, sides concave, apex acute, dorsally impressed.

Antenna 2 extending to end of peraeon segment 1 or a little beyond, 4th joint $1\frac{1}{2}$ times 3rd, 5th subequal to 3rd plus 4th, flagellum subequal to 5th, its 2nd joint twice length of 1st.

Peraeopods 1-3 in ♂ as in *truncata*.

Pleopod 1, outer branch about as broad as long, cordiform, outer margin slightly sinuous, more so in ♀ than in ♂.

Uropod, outer ramus longer than peduncle.

7-8 × 2.5-3 mm. Pale slaty-grey, mottled, eyes black.

Localities.—Cape Province: Steinkopf (Budde-Lund); Lilyfontein (K. H. B.); Clanwilliam (R. M. L.); Matjesfontein and Triangle * (W. F. P. and R. M. L.).

Great Namaqualand: Lüderitzbucht (Panning).

Niambia capensis (Dollf.).

(Figs. 23, *k-n*; 24, *c-i*.)

1895. *Metoponorthus capensis*. Dollfus, Mem. Soc. Zool. Fr., viii, p. 350, fig. 9.
 1904. *Niambia* „ Budde-Lund, Rev. Crust. Isop. Terr., p. 37.
 1906. „ „ *Id.*, Deutsch. Südpol. Exp., ix, p. 89.
 1909. „ „ *Id.*, in Schultze, Reise, ii, p. 63, pl. vi, figs. 39, 40.
 1909. „ *pusilla*. *Id.*, *ibid.*, p. 63, pl. vi, fig. 38.
 1909. „ *marginepapillosa*. *Id.*, *ibid.*, p. 64, pl. vi, fig. 41.
 1910. „ *capensis*. Stebbing, Gen. Cat. S. Afr. Crust., p. 441.
 1910. „ *pusilla* and *marginepapillosa*. *Id.*, *ibid.*, p. 442.

? *non* Panning, 1924, p. 173 (*pusilla*).

Surface with faint indications of granules.

Eyes with 12-16 ocelli.

Projecting portions of pleurae subequal to mid-dorsal length of segments, of 5 not extending to level of telsonic apex.

Telson, sides concave, apex acute, slightly impressed dorsally.

* Now called Matroosberg on the railway.

Antenna 2 extending to end of peraeon segment 2, 4th joint distinctly longer than 3rd, 5th subequal to 3rd plus 4th, flagellum subequal to 5th, its 1st joint distinctly longer than broad.

Peraeopods 1-3 in ♂ as in *truncata*.

Pleopod 1, outer branch usually longer than broad, outer margin in ♂ with a triangular, subacute process about in middle, in ♀ sinuous.

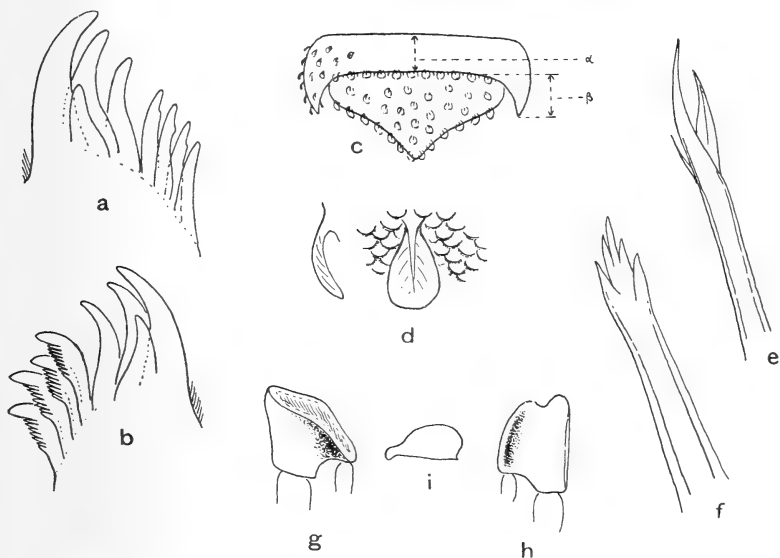


FIG. 24.—*Niambia*. *a, b*, Apex of outer lobe of maxilla 1 of *Niambia* sensu stricto and *Manibia* subgen. n. *N. capensis*; *c*, 5th pleon segment and telson, indicating how the relative lengths of the segment (α) and its pleural portion (β) are measured; *d*, surface and one scale-spine further enlarged, with profile of latter; *e, f*, spines from peraeopod 1 of ♂ and ♀ respectively; *g, h*, dorsal and ventral views of peduncle of uropod; *i*, cross-section of peduncle of uropod, dorsal surface uppermost, outer margin to right.

Uropod, outer ramus longer than peduncle.

Up to 6×2.5 mm., or slightly larger, up to 8×4 mm. Slaty-grey, mottled with paler on head and peraeon, usually a pale lateral mark on each peraeon segment (where the epimera join the segments), each pleon segment with 2 small pale dots, often faint or absent, but when present the two series converge posteriorly, antennae grey, legs more or less suffused, eyes black. Occasionally the peraeon is predominantly yellowish with 3 longitudinal dark stripes.

Localities.—Cape Province: Cape Town (Dollfus); Simonstown (Budde-Lund); Cape Peninsula generally (W. F. P., R. M. L., K. H. B.); Riebeck Kasteel (K. H. B.); Gouda (R. M. L.); Citrusdal

(K. H. B.); Clanwilliam (R. M. L.); Bitterfontein (K. H. B.); Lilyfontein (K. H. B.); Gordons Bay (W. F. P.); Caledon (W. F. P., K. H. B.); River Zonder End (K. H. B.); Swellendam (K. H. B.); Riversdale (K. H. B.); Ceres (W. F. P.); Forebay (K. H. B.); Pocaltsdorp and George (W. F. P.); Graaf Reinet and Beaufort West (S. H. H.); Avontuur (W. F. P.); Doorn River, Oudtshoorn District (S. H. H. and C. T.).

It seems clear that *pusilla* and *marginepapillosa*, recorded by Budde-Lund from the same locality as *capensis*, are synonymous, at least with Budde-Lund's species. It is not clear whether Budde-Lund actually saw Dollfus' type, but there is a noticeable conflict between Budde-Lund's concept of *capensis* and Dollfus' figure as regards the extent of the pleurae of pleon segment 5. Nor have I seen among the specimens here referred to *capensis* any with such slender 2nd antennae as shown in Dollfus' figure, in which they correspond more with those of a *Gerufa* than a *Niambia*. I have, however, seen a Cape Town specimen corresponding exactly in coloration with Dollfus' description.

Panning has recorded *pusilla* from Penguin Island, off Lüderitzbucht; but unless a large series of specimens is collected at one and the same time and place, the identification of such small specimens is very uncertain.

Similar growth changes to those mentioned under *truncata* occur in this species also, as regards the antennae and telson. In young ♂ the outer branch of pleopod 1 has the outer margin entire, the projection develops gradually.

Like *truncata*, this species inhabits low levels and the lower slopes of the mountains; in the Cape Peninsula it does not seem to ascend above 1000 or 1500 feet. I have found it under logs on a sandy beach (Forebay).

Niambia formicarum n. sp.

Resembling very closely *capensis*. Antenna 2 shorter and stouter, reaching only to end of peraeon segment 1, 5th joint not as long as 3rd plus 4th, flagellum slightly shorter than 5th, its 1st joint scarcely longer than broad.

Eyes small, inconspicuous, 8-9 ocelli.

5-8 × 2.25-4 mm. Uniform pale yellowish or cream, eyes rather pale.

Localities.—Cape Province: River Zonder End (K. H. B.); Caledon (K. H. B.); Matjesfontein (W. F. P.); Touws River (R. M. L.); Laingsburg (W. F. P.); Prince Albert Pass (W. F. P.); Clanwilliam (S. A. Mus.).

This form is scarcely more than a variety of *capensis*, though it differs markedly in the number of ocelli. The habitat, however, is different as it seems always to be associated with ants (*Messor* and *Camponotus*). Two ♀♀ from a termite nest at Fort Brown (Albany Mus.) appear to belong to this species, but in the absence of ♂♂ they are not definitely assigned here.

Niambia longicauda Brnrd.

(Fig. 25.)

1924. *Niambia* (?) *longicauda* Barnard, Ann. S. Afr. Mus., xx, p. 235, fig. 4.

Surface minutely granulate.

Eyes small, ocelli 10.

Projecting portions of pleurae twice mid-dorsal length of segments, 5 extending to level of about $\frac{2}{3}$ – $\frac{3}{4}$ telsonic length. Telson nearly as long as broad, lateral margins strongly concave, converging to long acute apex, dorsally impressed.

Antenna 2 reaching to, or a trifle beyond, end of peraeon segment 1, 4th joint distinctly, though not greatly, longer than 3rd, 5th slightly longer than 4th, flagellum shorter than 5th, its 2nd joint twice 1st.

Peraeopods 1–3 in ♂ as in *truncata*, but the spines very stout, apically slightly clavate, 3- or 4-dentate.

Pleopod 1, outer branch longer than broad, especially in ♂, apex rounded, outer margin excised, outer and inner margins in ♂, outer margin in ♀, thickly set with very minute scabrosities.

Pleopod 2, outer branch in ♂ subtriangular, longer than broad, apex acute, outer margin minutely scabrous.

Uropod, outer ramus subequal to peduncle.

5 × 2 mm. Slaty-grey, with pale markings, antennae and legs pale, uropods more or less suffused.

Localities.—Damaraland: Sandup (Barnard); Tsumeb (K. H. B.);

Namutoni (K. H. B.); Outjo (K. H. B.).

Ovamboland: Andoni (Barnard).

Kaokoveld: Kamanyab (K.H.B.); Warmbad (R.F.L.);

Kaoko Otavi (K. H. B.).

A very distinctive species, both in the telson and the pleopods.

Manibia subgen. n.

Differing from typical *Niambia* in having the inner spines of the outer lobe of maxilla 1 strongly serrate. Flagellum of antenna 2 with the 2nd joint $2\frac{1}{2}$ –3 times the length of the 1st.

In both the species described below no more than 4 inner spines on the outer lobe of maxilla 1 could be detected (cf. *griseo-flavus*).

This subgenus bears a similar relationship to *Niambia* as *Benthana* and *Benthanops* do to *Philoscia*.

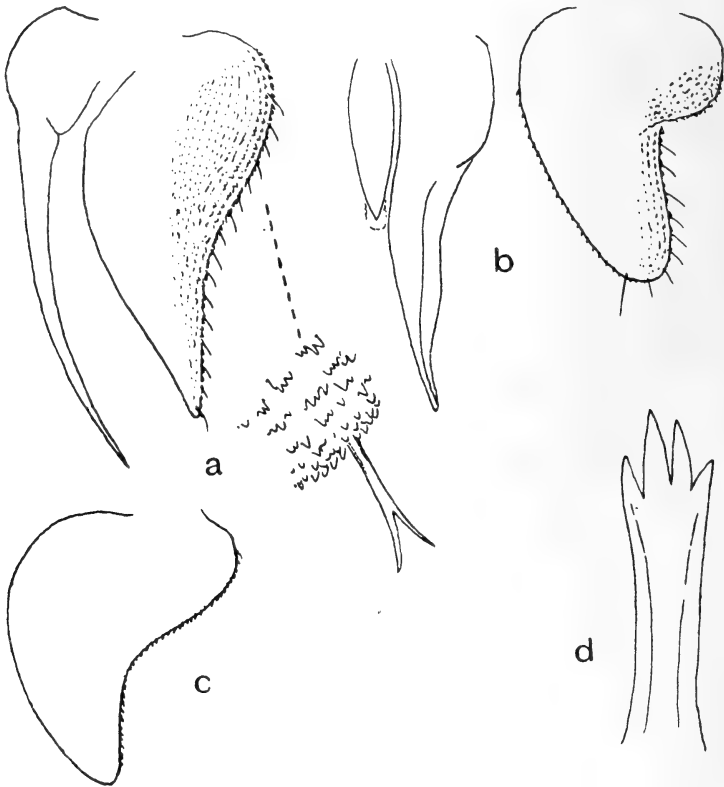


FIG. 25.—*Niambia longicauda* Brnrd. *a*, Pleopod 2 ♂ with portion of margin further enlarged; *b*, penis and pleopod 1 ♂, outer ramus separated; *c*, outer ramus of pleopod 1 ♀; *d*, spine from 5th joint of pereopod 1 ♂.

Niambia (Manibia) lata n. sp.

(Figs. 23, *j*; 24, *b*; 26.)

Unusually broad. Surface minutely granulate.

Head deeply sunk in peraeon segment 1, the antero-lateral angles of the latter extending to the anterior margin of eyes. Eyes small, ocelli 10.

Epimera of segments 2-4 in ♀ demarcated.

Projecting portions of pleurae $1\frac{1}{2}$ -2 times mid-dorsal length of segments, 5 extending to level of telsonic apex. Telson very short, sides concave, apex acute, dorsally impressed.

Antenna 2 reaching slightly beyond end of peraeon segment 1, 4th joint slightly longer than 3rd, flagellum a little longer than 5th, its 2nd joint 3 times 1st.

Pleopod 1, outer branch in ♀ about as long as broad, apex blunt, outer margin angularly incised.

Uropod, outer ramus longer than peduncle.

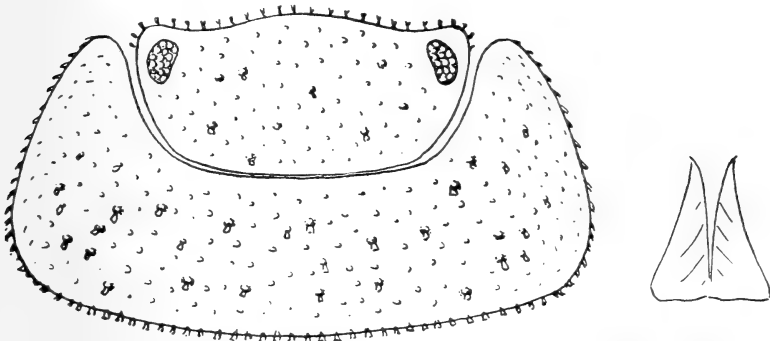


FIG. 26.—*Niambia* (subgen. *Manibia*) *lata* n. sp. Head and peraeon segment 1, with scale-spine further enlarged.

4.5 × 2.8 mm. As preserved, pale grey, with lighter markings, antennae, legs and uropods pale.

Locality.—S. Rhodesia : Sanyati Valley (S.A. Mus.).

This species is considerably broader proportionately to its length than any other species of *Niambia*. The single ovigerous ♀ was collected by Capt. R. H. Stevenson.

Niambia (*Manibia*) *microps* n. sp.

Not unusually broad. Surface minutely granulate.

Head not deeply sunk in peraeon segment 1, resembling typical *Niambia*. Eyes very small, ocelli 6.

Epimera of segments 2-4 in ♀ demarcated.

Projecting portions of pleurae $1\frac{1}{2}$ times mid-dorsal length of segments, 5 extending nearly to level of telsonic apex. Telson very short, sides concave, apex acute, dorsally impressed.

Antenna 2 reaching to end of peraeon segment 1, 3rd and 4th joints subequal, flagellum equal to 5th, its 2nd joint $2\frac{1}{2}$ times 1st.

Pleopod 1, outer branch in ♀ resembling that of *lata*.

Uropod, outer ramus longer than peduncle.

4.5 × 2 mm. (ovig. ♀). As preserved, yellowish with indications of slaty-grey coloration, antennae, legs pale, eyes black.

Locality.—Portuguese East Africa: Maxixe, near Inhambane (R. F. L.).

Although no ♂ is present, the small number of ocelli indicate that this form is distinct from any of the other species.

Gen. GERUFA B-L.

1909. *Gerufa*. Budde-Lund in Schultze, Reise, ii, p. 58 (subgen. of *Porcellio*).

1910. „ *Id.*, Sjöstedt, Kilimandjaro-Meru Exp., iii, 21, pp. 8, 9, 10.

Surface shagreened, densely covered with usually clavate or battle-dore-shaped scales, which are most numerous laterally and on the margins of the segments, and on telson; sometimes the scales may be spine-like or apically forked.

Head discrete. Eyes large, prominent, ocelli at least 18, usually 20–22.

Epimeral sutures present on segments 2–4 in ♀.

Pleurae of pleon segments 3–5 well developed.

Telson short, rounded-triangular, dorsally convex, not impressed.

Antenna 2 long, slender, flagellum 2-jointed, 1st joint $\frac{1}{2}$ – $\frac{3}{4}$ length of 2nd.

Mouth-parts as in *Niambia* (*sensu stricto*).

Peraeopods as in *Niambia*. Dactylar seta apically acute.

Pleopods without pseudotracheae.

Uropod, peduncle stout, external surface flattened and impressed, *i.e.* triquetral in cross-section, the dorsal margin marked by a faint keel, the ventral margin by a strong keel, outer ramus longer than peduncle, slender.

Although closely allied to *Niambia*, this genus is easily distinguished by the flattened outer surface of the peduncle of uropod, and the more slender outer ramus of uropod, and antenna 2.

Contrary to what is found in *Niambia*, where the outer branch of pleopod 1 in ♂ often forms useful specific characters, there is in the present genus a uniformity which renders this appendage of no specific value.

In conflict with Budde-Lund's statement and figure, I find only 4

large inner spines on the outer lobe of maxilla 1, as in *Niambia*. Owing to the refraction of the chitin of these spines, and the frequent overlapping of their bases, an optical illusion is easily possible causing the appearance of a slender and shorter simple spine between two of the apically bifid ones (cf. Budde-Lund's fig. 46, pl. vi, 1909). The only certain way to determine the number of spines is to separate and splay them with a fine needle before mounting on the slide.

The species of this genus are typically mountain forms.

This genus is not to be confused with the Eubeline genus *Gerutha* B-L., 1912.

Key to the South African species.

1. Scale-spines clavate, subtriangular.
 - a. Eyes not very large.
 - i. Smaller : 7×3 mm. *hirticornis*.
 - ii. Larger : 11×5 mm. *montana*.
 - b. Eyes very large *macrops*.
2. Scale-spines hair-like, slender, apically forked *marmorata*.

Gerufa hirticornis B-L.

(Fig. 27.)

1909. *Gerufa hirticornis*. Budde-Lund in Schultze, Reise, ii, p. 59, pl. vi, figs. 42-56.

1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 442.

Surface with numerous low rounded granules, scale-spines subtriangular, apically truncate.

Eyes with 20-22 ocelli.

Projecting portions of pleurae $1\frac{1}{2}$ times longer than mid-dorsal length of segments, 5 not extending to level of telsonic apex. Telson rounded triangular, sides straight or slightly convex.

Antenna 2 reaching to middle or end of peraeon segment 3, with rather long outstanding setae arranged in longitudinal rows.

Peraeopods 1-3 in ♂, 4th and 5th joints with numerous spines on lower surface ; in ♀ spines less numerous. The marginal spines in all the peraeopods in both sexes are more or less expanded, in some cases a single expansion on either side, in some cases a double expansion ; sometimes no expansion at all is visible.

Pleopod 1, outer branch in ♂ as broad as long, apex blunt, outer margin nearly straight ; in ♀ broader than long.

Uropod, outer ramus $1\frac{3}{4}$ to almost 2 times length of peduncle.

Up to 7×3 mm. ($\sigma\sigma$ smaller than ♀♀). Slaty-grey, with pale mottling on head and peraeon, a series of pale marks along each side at junctions of epimera, and often another pale mark externally, pleon usually with 2 large pale spots on each segment, the two series diverging posteriorly, telson also with pale marks, antennae, legs and uropods suffused with grey, eyes black.

Localities.—Cape Province: Cape Flats (Budde-Lund); Cape Peninsula (K. H. B.); French Hoek (W. F. P.); Hottentots Holland

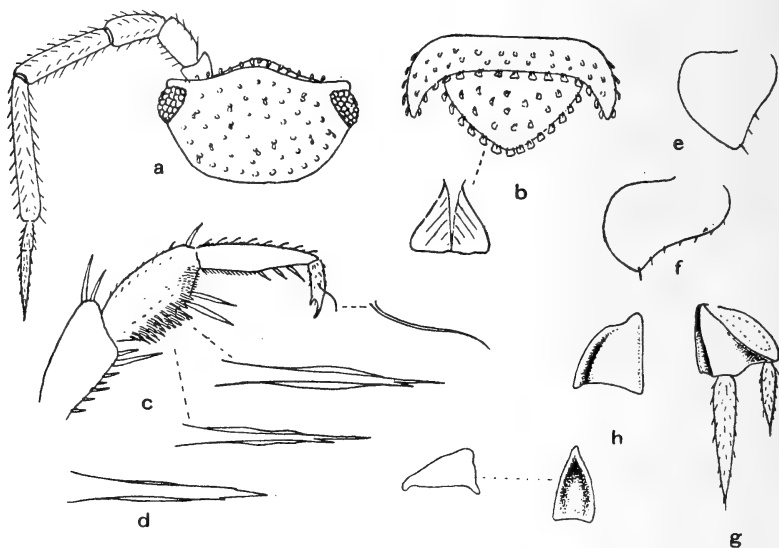


FIG. 27.—*Gerufa hirticornis* B-L. a, Head and antenna 2; b, pleon segment 5 and telson, with scale-spine further enlarged; c, distal joints of peraeopod 1 σ , with dactylar seta and 2 spines further enlarged; d, spine from peraeopod of ♀ ; e, f, outer ramus of pleopod 1 σ and ♀ respectively (inner margin to left); g, dorsal view of left uropod; h, ventral view of peduncle of uropod, with outer view and cross-section, in the latter dorsal surface above, outer margin to right.

Mts. (K. H. B.); Wellington Mts. (K. H. B.); Great Winterhoek Mts., Tulbagh (K. H. B.); Waaihoek Mts., Goudini (K. H. B.); Keeromberg and Hex River Mts., Worcester Distr. (K. H. B.); Riebeck Kasteel Mt. (K. H. B.); Kleinmond Mts. (K. H. B.); Caledon (K. H. B.); Montagu (K. H. B.); Langeberg Mts. at Swellendam, Riversdale, and Heidelberg (K. H. B.); Seven Weeks Poort Berg in the Zwartberg Range (K. H. B.); Doorn River, N. of Montagu Pass, Outeniqua Range (S. H. H. and C. T.); Cedarberg Mts., Clanwilliam (K. H. B.).

The two rows of short stout spines on the 2nd joint of antenna 2

shown in Budde-Lund's figure are not apparent. The irregularity in the occurrence of the expansions on the spines on the peraeopods may possibly be due to some action of the preserving fluid; nevertheless these peculiar spines seem to be characteristic.

Although Budde-Lund recorded this species from the Cape Flats (coll. Schultze) I have not found it in such low-lying localities; it occurs on the slopes of the mountains from about 1000 ft. upwards (Cape Peninsula), and is a characteristic mountain woodlouse, living at 5000 ft. on the Great Winterhoek Mts. and Langeberg Range, and 7000 ft. on the Zwartberg Range.

The diverging series of large pale spots on the pleon, often confluent into two stripes, are characteristic, though they may be entirely obsolete. Contrast the *converging* series of *small* dots in *Niambia capensis*.

Gerufa montana n. sp.

(Fig. 28, c.)

Surface with faint indications of granules, scale-spines rather narrow, apically more or less bifid.

Eyes with 20 ocelli.

Projecting portions of pleurae $1\frac{1}{2}$ –2 times longer than mid-dorsal length of segments, 5 extending to level of about two-thirds length of telson. Telson triangular, sides straight, apex narrowly rounded, slightly convex dorsally.

Antenna 2 extending to about middle of peraeon segment 3, slender, 4th joint nearly twice as long as 3rd, flagellum shorter than 5th, subequal to 4th, its 1st joint about three-quarters length of 2nd. The rows of outstanding setae relatively shorter and less conspicuous than in *hirticornis*.

Peraeopods and pleopods as in *hirticornis*.

Uropod, outer ramus $1\frac{3}{4}$ times length of peduncle.

11 × 5 mm. Slaty-grey, with lighter markings on either side of median line, pleon uniform, telson with 2 pale dots, epimeral sutures on segments 2–4 in ♀ marked with pale lines, antennae grey, legs and uropods more or less suffused, eyes black.

Localities.—Cape Province: Great Winterhoek Mts., Tulbagh, 5000 ft. (K. H. B.); Langeberg Range, N. of Riversdale and Heidelberg, 3500–4000 ft. (K. H. B.); Seven Weeks Poort Berg in Zwartberg Range, 7000 ft. (K. H. B.).

This species resembles *hirticornis* in the relative size of the eyes and other features, but is a much larger species.

Gerufa macrops n. sp.

(Fig. 28, a, b).

Surface with faint indications of granules, scale-spines subtriangular, less numerous and narrower than in *hirticornis*, apically excised.

Eyes very large, composed of 18 large ocelli.

Projecting portions of pleurae $1-1\frac{1}{2}$ times mid-dorsal length of segments, 5 not reaching level of telsonic apex.

In other respects resembling *hirticornis*.

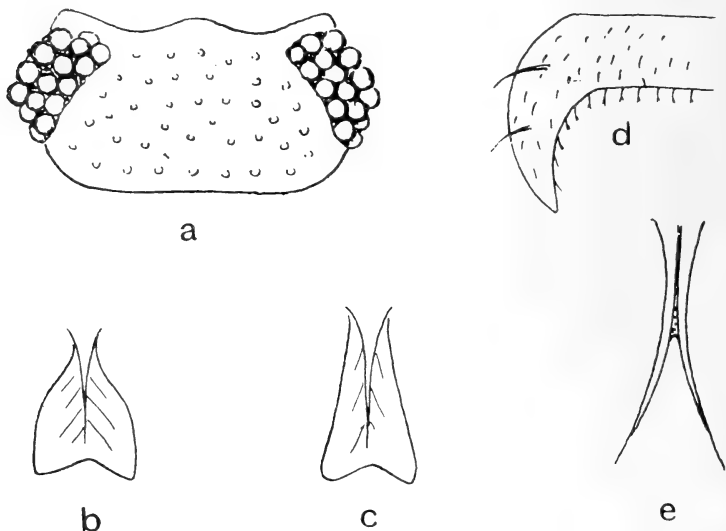


FIG. 28.—*Gerufa*. a, b, Head and scale-spine of *macrops* n. sp.; c, scale-spine of *montana* n. sp.; d, e, part of 5th pleon segment, and scale-spine of *marmorata* n. sp.

10×5 mm. (♂♂ smaller). Colour as in *hirticornis*, but more frequently mottled, *i.e.* the dark and light colours more equal in proportion, sometimes the pale colour predominating.

Localities.—Cape Province: Oudebosch, River Zonder End Mts. (K. H. B.); Swellendam Mts. (K. H. B.).

This species is also a mountain species. It does not, however, occur in such open habitats on the slopes or near the crests of the ranges as *hirticornis*, but in the forest and bush in the ravines. Thus it is common in the Oudebosch at River Zonder End, and in the upper portions of the "Duivelsbosch" at Swellendam.

Though composed of fewer ocelli than in *hirticornis*, the eyes are much larger; the head looks almost like that of a *Ligia*.

Gerufa marmorata n. sp.

(Fig. 28, d, e.)

Surface with faint indications of granules, thickly covered with slender spine-like or hair-like scale-spines, with a few scattered longer ones laterally on the epimera and pleura, the scale-spines on the hind margins of the segments and on the telson slender, deeply forked.

Eyes with 20 ocelli.

Projecting portions of pleurae $1\frac{1}{2}$ –2 times mid-dorsal length of segments, 5 extending to about level of half telsonic length. Telson rounded-triangular, sides straight or very slightly concave, apex blunt, not dorsally impressed.

Antenna 2 extending to end of peraeon segment 2, or middle of 3.

Peraeopods and pleopods as in *hirticornis*.

Uropod, outer ramus $1\frac{1}{2}$ times length of peduncle.

10–11 \times 4–5 mm. ($\sigma\sigma$ smaller). Various mottled and marbled with slaty-grey, rufous, fulvous brown, orange, or yellow, some specimens predominantly slaty-grey, others rufous, fulvous, or yellowish, antennae and uropods grey, brown or reddish, legs more or less suffused, eyes black.

Localities.—Cape Province: George (K. H. B.); Wilderness, near George (S. H. H. and C. T.); Knysna (R. F. L. and J. D.); Keurbooms River (K. H. B.); Doorn River, N. of Montagu Pass, Outeniqua Range (S. H. H. and C. T.).

This very beautiful species is common in the bush and forest areas of the above localities. The colour pattern is quite different from that of the other species.

Inchanga n.g.

Surface thickly covered with scale-spines, obovate in shape.

Head discrete, with frontal margin. Eyes small, 8–10 ocelli.

Epimera of segments 2–4 in φ demarcated.

Pleurae of pleon segments 3–5 well developed.

Telson triangular, apically acute.

Antenna 2, flagellum 2-jointed, 2nd much longer than 1st.

Mandible with a single free penicil, molar penicil with short stem and several branches, outer margin without spines.

Maxilla 1, outer lobe with 4 + 4 spines, one of the outer spines very slender, 2 of the inner spines feebly bifid, 2 simple; inner lobe with 2 subequal plumose setae.

Maxilliped, inner plate with 2 denticles near outer distal corner, and 1 spine near inner distal corner.

Peraeopods 1-3 more strongly spinose in ♂ than ♀. Dactylar seta slender, acute.

Pleopods with rudimentary pseudotracheae.

Uropod, peduncle with fine longitudinal keel on outer margin, and distally slightly excised, inner ramus inserted proximally.

This genus somewhat resembles *Trichorina*, but the peduncle of uropod is like that of *Agnara* or *Angara* (= *Agabiformius*) (subgenera of *Porcellio*). From *Nagara* (also a subgen. of *Porcellio*) it differs in having no spines on outer margin of mandible. The outer lobe of maxilla 1 with its very slender spine is distinctive, though reminiscent of *Thomsonia* (p. 258).

Inchanga natalensis n. sp.

(Fig. 29.)

Surface finely and closely covered with larger and smaller granules, the larger ones forming two more or less distinct transverse series on peraeon segments 2-4, and a single series on segments 5-7.

Head, frontal margin distinct, costate, slightly produced in middle, lateral lobes small, considerably below level of front margin, rounded, front minutely granulate, slightly bulbous in middle and concave below. Eyes small, 8-10 ocelli.

Antero-lateral angles of peraeon segment 1 rounded, reaching eyes. Projecting portions of pleurae twice mid-dorsal length of segments, 5 not reaching telsonic apex. Telson triangular, sides concave, apex acute, dorsally impressed.

Antenna 2 reaching only just beyond end of 1st peraeon segment, 3rd and 4th joints subequal, 5th shorter than 3rd plus 4th, flagellum shorter than 5th, its 1st joint one-third length of 2nd.

Pleopod 1, outer branch longer than broad, in ♂ apex acute, outer margin strongly sinuous, in ♀ apex subacute, outer margin less sinuous.

Uropod, peduncle not quite reaching telsonic apex, outer margin flattened, with a keel on lower margin, and apically shortly incised, outer ramus longer than peduncle, outer margin feebly keeled, inner ramus more than half length of outer ramus, slender.

4.5 (♂)-6.5 (♀) × 2-3 mm. Pale straw, faintly irrorated with light grey along the sides of peraeon and pleon, and hind margins of peraeon segments, eyes black.

Locality.—Natal: Inchanga (K. H. B., 1917).

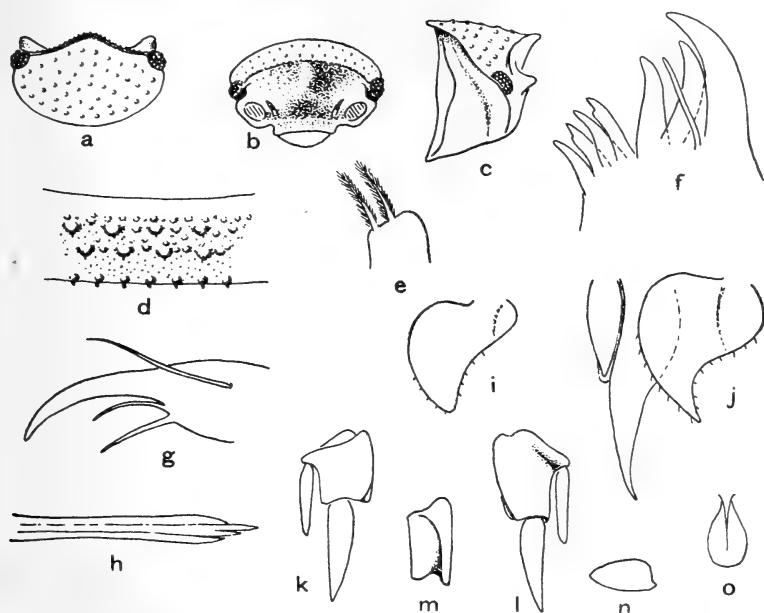


FIG. 29.—*Inchanga natalensis* n.g., n. sp. *a, b, c*, Dorsal, frontal, and lateral views of head; *d*, portion of peraeon segment 2; *e, f*, apices of inner and outer lobes of maxilla 1; *g*, dactylus of peraeopod; *h*, spine from 5th joint of peraeopod 1; *i*, outer ramus of pleopod 1 ♀; *j*, penis and pleopod 1 ♂; *k, l*, dorsal and ventral views of uropod; *m*, outer view of peduncle of uropod; *n*, cross-section of peduncle of uropod, dorsal surface above, outer margin to right; *o*, scale-spine.

Inchanga (?) *virgiliae* n. sp.

(Fig. 30.)

Peraeon strongly convex, the epimera bent outwards nearly horizontally. Surface with larger and more closely set granules than in *natalensis*, but covered with similar scale-spines. Granules forming about 5 transverse series on peraeon segment 1, and 3 series on segments 2-7.

Head similar in structure to that of *natalensis*, but the front more strongly produced in the middle line, and the lateral lobes larger and more prominent.

Epimera subquadrangular, anterior angle of 1st somewhat acutely produced forwards.

Antenna 2 missing. In other respects, including the mouth parts, peraeopods with their spines, and the uropods agreeing with *natalensis*.

4.5 × 1.5 mm. Pale greyish, epimera and pleurae with unusually wide pale margins (dotted line in figure).

Locality.—Cape Province: Keurbooms River, Plettenberg Bay District (K. H. B., 1931).

A single specimen found under a log on the banks of the estuary (*Virgilia capensis*, the Keurboom tree).

Although resembling *natalensis* in the structure of the head and the mouth parts, the strongly convex body with its nearly horizontal

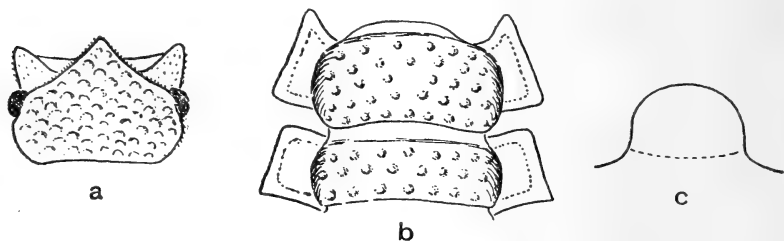


FIG. 30.—*Inchanga* (?) *virgiliae* n. sp. *a*, Dorsal view of head; *b*, peraeon segments 1 and 2; *c*, diagrammatic cross-section of peraeon.

epimera is so different that I place the species in the genus *Inchanga* with some considerable doubt, pending the discovery of more material.

Krantzia n.g.

Surface sparsely covered with minute obovate scale-spines.

Head concrete, lateral margin continued round below eye on to lateral lobe, frontal margin distinct. Eyes small, submarginal, 10 ocelli.

Epimera of segments 2–4 in ♀ demarcated.

Pleurae of pleon segments 3–5 moderately developed, acute.

Telson triangular, apically rounded.

Antenna 2, flagellum 2-jointed, 1st joint slightly shorter than 2nd.

Mandible with a single free penicil, molar penicil branched, with a short stem, outer margin without spines.

Maxilla 1, outer lobe with 4 + 4 spines, the inner ones strong, simple.

Maxilliped, inner plate with sharp point on inner distal corner, and a subterminal spine.

Peraeopods 1–5 with strong fringe of spines in ♂, 6 also more strongly spinose in ♂ than in ♀, 7 strongly dimorphic in ♂ and ♀. Dactylar seta slender, acute.

Pleopods without pseudotracheae.

Uropod, peduncle with outer margin entire, keeled, inner ramus inserted proximally.

On referring to Budde-Lund's conspectus of the Oniscine genera (1910, p. 8 *sqq.*) this form runs down to the genera Nos. 8-13, but none of these have a "concrete" head. In side view the form of the head closely resembles that of *Sunniva* (*cf.* Budde-Lund in Voeltkow, Reise, pl. xii, fig. 2), but the margins of the first 2 peraeon segments are not cleft posteriorly. This latter character will also exclude *Saidjahus* and *Ambounia* (for the latter see Omer-Cooper, 1926, p. 352, where the name is erroneously spelt "*Ambouina*") among the Spherillionine genera with biarticulate flagellum to antenna 2.

In general appearance this form is a Porcellionid, and the modification of the 7th peraeopod in ♂ resembles that in certain species of *Porcellio* (Sars, 1898) or *Periscyphis* (Omer-Cooper, 1926).

Krantzia poecila n. sp.

(Fig. 31.)

Surface with scattered minute scale-spines, chiefly laterally and on hind margins of segments, and on telson.

Head, front margin bluntly produced beyond level of lateral lobes, disappearing laterally above the eyes, lateral lobes rounded, a slight transverse groove behind frontal margin, front with slight median vertical ridge, concave below. Eyes small, ocelli 10.

Projecting portions of pleurae subequal to mid-dorsal length of segments, 5 not reaching to level of telsonic apex. Telson broader than long, triangular, apex broadly rounded, sides slightly concave.

Antenna 2 slender, reaching middle of peraeon segment 3, 4th joint twice 3rd, 5th not quite as long as 3rd plus 4th, flagellum shorter than 5th, its 1st joint two-thirds length of 2nd.

Peraeopods 1-5 in ♂, 4th and 5th joints with dense fringe of apically expanded spines, 6th with a few spinules and setules on inner margin; in ♀ 4th and 5th joints with few spines.

Peraeopod 6 in ♂, 4th and 5th joints with simple spines and setules on inner margin; in ♀ similar but spines less numerous.

Peraeopod 7 in ♂ stronger than the other peraeopods, 3rd joint lobed on anterior surface of the outer margin, inner apex produced in a short subacute point, 4th shorter and narrower than 3rd, its lower (inner) margin keeled, basal angle subquadrate, 5th cylindrical, longer than 4th, 6th longer and narrower than 5th; in ♀ not differing from peraeopod 6. Dactylar seta in all peraeopods slender, acute.

Pleopod 1, outer branch in ♂ ovoid, apically bluntly rounded, outer margin slightly excised apically, inner branch very stout, apex curved outwards; in ♀ outer branch transversely oblong.

Uropod, peduncle broader than long, outer margin entire, keeled, outer ramus longer than inner, which itself is slightly longer than peduncle, outer margin of outer ramus deeply grooved.

5.5 × 2 mm. (♂), 6.5 × 2.75 mm. (♀). Pale straw colour, marbled with brown or purplish brown, a medio-dorsal dark line more or less

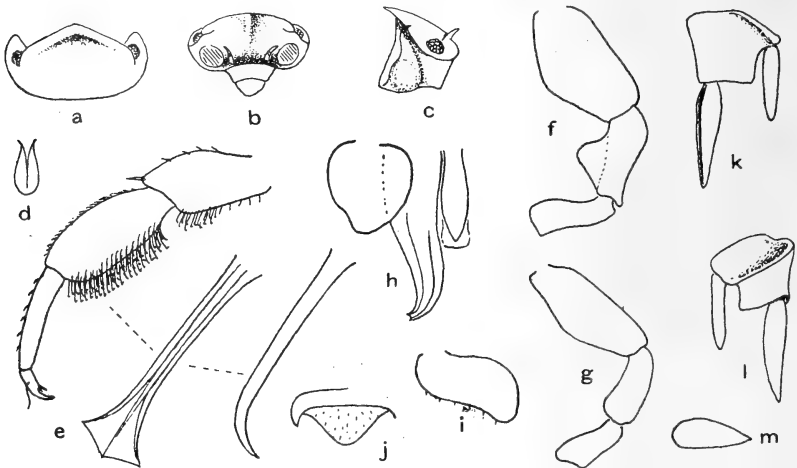


FIG. 31.—*Krantzia poecila* n.g., n. sp. a, b, c, Dorsal, frontal, and lateral views of head; d, scale-spine; e, distal joints of pereopod 1 ♂, with frontal and profile views of spines further enlarged; f, g, 2nd-4th joints of pereopod 7 ♂ and ♀ respectively; h, penis and pleopod 1 ♂; i, outer ramus pleopod 1 ♀ (inner margin to right); j, 5th pleon segment and telson; k, l, ventral and dorsal views of uropod; m, cross-section of peduncle of uropod, outer margin to right.

distinct, 1st-3rd joints of antennae pale, rest brown, legs and uropods pale, eyes black.

Localities.—Natal: Krantzkop, Pietermaritzburg, and Inchanga (K. H. B., 1917).

The spines of the anterior pereopods in ♂ in an ordinary mounted preparation appear to be simply hooked, the points being deflexed proximally. When specially mounted, however, they are seen to be apically expanded, as shown in the figure. Spines of this shape have not been found as yet in any other South African woodlouse.

Hiatoniscus n.g.

Head concrete. Eyes marginal. Epimera more or less contiguous. Pleon rather broad, pleurae lamellate. Telson triangular, apically produced.

Flagellum of antenna 2 2-jointed. Mandible with 1 free penicil, molar penicil consisting of a tuft of setae. Inner spines on outer lobe of maxilla 1 bifid, inner lobe with apex scarcely wider than the bases of the 2 subequal elongate, plumose setae. Maxilla 2 with the outer apical division (representing the outer lobe) larger than inner. Maxilliped with inner plate spinulose. Peraeopods 1-3 in ♂ with rather more numerous spines than in ♀; peraeopod 1 in ♂ with large patch of spinules on anterior surface of 5th joint. Peraeopod 7 not sexually dimorphic. Dactylar seta on all peraeopods simple, acute. Five pairs of brood lamellae. Pleopods without pseudotracheae. Uropod, peduncle rather thin dorso-ventrally, and thinning to the outer edge, which is sharply keeled, and extends without bifurcation to the insertion of outer ramus, inner ramus inserted basally, longer than outer ramus.

Resembling *Oniscus* in the pleopods and uropods, but with a 2-jointed antennal flagellum. It differs, however, from both *Oniscus* and *Porcellio* in the concrete head, and the 2nd maxillae and mandibles. The uropod is remarkably like that of *Periscyphis* or *Hiallum*. The name is taken from the gaps between the epimera in the first species.

There is a superficial resemblance to *Mahehia* B-L., 1912, but the plumose setae on inner lobe of maxilla 1 constitute a decisive difference.

Key to the species.

- | | | | | |
|----------------------------------------------------|---|---|---|---------------------|
| 1. Depressed, granulate, with gaps between epimera | . | . | . | <i>griseus</i> . |
| 2. Convex, smooth, no gaps between epimera | . | . | . | <i>contractus</i> . |

Hiatoniscus griseus n. sp.

(Fig. 32, a-i.)

Body subdepressed. Surface strongly granulate. Frontal margin of head forming a wide, gently convex lobe, a deep groove behind the raised edge, marginal line continuous with the lateral lobe (antennary tubercle) and fading out on the front below the frontal margin, front of the head with a slightly raised vertical ridge; eyes marginal, with about 24 ocelli.

Antero-lateral angles of peraeon segment 1 reaching nearly to

lateral lobes of head. Transverse rows of rounded tubercles in 5 series on segment 1, in 3 series on segments 2-6, and 2 series on segment 7. Anterior margins of epimera of segments 2-7 more or less obliquely bevelled off.

A single transverse row of tubercles on each of pleon segments 1-5. Telson longer than basal width, distally produced into a subacute point, 2-3 transverse rows of tubercles, but always a pair of tubercles at the base (laterally) of the apical depression or groove.

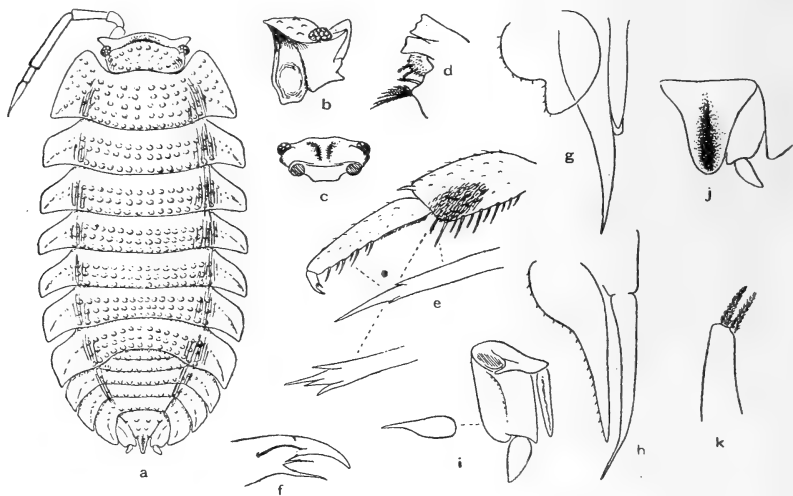


FIG. 32.—*Hiatoniscus griseus* n.g., n. sp. *a*, Whole animal; *b*, *c*, lateral and frontal views of head; *d*, apex of mandible; *e*, distal joints pereopod 1 ♂, with spines further enlarged; *f*, dactylus of pereopod; *g*, penis and pleopod 1 ♂; *h*, pleopod 2 ♂; *i*, dorsal view of uropod, with cross-section of peduncle, dorsal surface uppermost, outer margin to left. *H. contractus* n. sp.: *j*, telson and uropod; *k*, inner lobe of maxilla 1.

Antenna 2, 2nd joint not strongly expanded internally, 5th half as long again as 4th, flagellum shorter than 5th joint, 2nd joint nearly twice length of 1st.

Mandibles with cutting edge entire or feebly tridentate, secondary cutting edge obscurely bifid, one free penicil, molar penicil consisting of a tuft of setae. Maxilla 1, inner spines of outer lobe bifid. Maxilla 2, outer apical division larger than inner division. Maxilliped, inner plate with 2 spinules on inner and 2 on outer apex.

Pereopods 1-3 in ♂ without a strong brush of spines, but with more spines than in ♀; pereopod 1 with a patch of short spinules on inner anterior surface of 5th joint.

Pleopod 1 in ♂, inner branch tapering to a fine acute point, outer

branch cordiform, with outer margin excised (as in *Oniscus asellus*). Pleopod 2 in ♂, outer branch with inner angle strongly and slenderly produced.

Uropod, peduncle oblong, longer than broad, outer ramus short, subequal to width of peduncle, inner ramus inserted basally, half as long again as outer ramus.

Up to 11 × 6 mm. Slaty-grey on a semi-transparent whitish ground colour, the grey portions being chiefly the lateral parts of the peraeon and pleon, the posterior margins of the segments, tubercles, and the front of the head above insertion of the antennae, eyes black; in alcohol the whole animal, except the eyes, fades to a yellowish white.

Localities.—Cape Province: Table Mt. and Kalk Bay Mts., Cape Peninsula (K. H. B.); Hottentots Holland Mts. (K. H. B.); Zwartberg at Caledon (K. H. B.).

This species only occurs at the upper levels, in the ravines and in damp places near krantzies at the top of the mountains. It is found under stones, but prefers living under one stone resting on another rather than under stones resting directly on the ground.

Hiatoniscus contractus n. sp.

(Fig. 32, j, k.)

Body convex. Surface minutely squamulose-granulose, the lateral rugae very feebly developed. Head similar to that of *griseus*, but the epistome relatively more gibbous in consequence of its being less excavated on either side of the middle line for the reception of the 2nd antennae; lateral lobes (antennary tubercles) in dorsal view less prominent, rounded.

Epimera without any unusual intervening gaps.

Telson apically less acute than in *griseus*, rounded, dorsally with shallow median longitudinal groove almost from base to apex.

Antenna 2, flagellum with 1st joint much shorter than 2nd, scarcely more than one-quarter its length. Peraeopods rather stouter than in *griseus*. Uropod, inner ramus a little longer than peduncle and extending to apex of telson.

7 × 3 mm. Slaty-grey, with subparallel series of pale marks in the position of the lateral rugae on peraeon segments. The Riversdale specimens are more abundantly marked with paler, there being a medio-dorsal stripe and a series of marks at junctions of epimera with their segments.

Localities.—Cape Province: Langeberg Mts. at Swellendam and Riversdale, 3000–4500 ft. (K. H. B., 1925, 1926).

Except as regards the above characters this species resembles *griseus*. The peraeopods are armed in the same manner and with the same types of spines.

Gen. RHYSCOTUS B-L.

- | | |
|-----------------------------|-----------------------------------------------------------------------|
| 1879. <i>Stenomacrus</i> . | Budde-Lund, Prosp. Gen. spec. Crust. Isop. Terr., p. 5 (nom. nud.). |
| 1885. <i>Rhyscotus</i> . | <i>Id.</i> , Crust. Isop. Terr., p. 191. |
| 1905. „ | Richardson, Bull. U.S. Nat. Mus., No. 54, p. 630. |
| 1905. <i>Hypergnathus</i> . | <i>Id.</i> , <i>ibid.</i> , p. 631. |
| 1908. <i>Rhyscotus</i> . | Budde-Lund in Voeltzkow, Reise, ii, p. 298 (conspectus spec.). |
| 1928. „ | Jackson, Proc. Zool. Soc., i, p. 586 (morphology of head). |
| 1928. „ | <i>Id.</i> , Quart. J. Microsc. Sci., lxxi, p. 527 (hermaphroditism). |
| 1930. „ | Arcangeli, Boll. Lab. Zool. Portici, xxv, p. 30. |

Head discrete. Epistome (Jackson: frontal lamina) strongly gibbous, separated from head by a groove.

Pleon narrower than peraeon, but not much narrower, pleurae of segments 3–5 moderate or rather small.

Telson triangular.

Antenna 2, flagellum 2-jointed, the joints subequal, or 2nd longer than 1st.

Mandible with one free penicil, molar penicil composed of a tuft of plumose setae.

Maxilla 1, outer lobe with 4 + 1 + 5 spines, one very slender spine adjoining the 4 strong outer ones, the inner 5 (or 4 of them) minutely serrate or pectinate; inner lobe with 2 subequal plumose setae.

Maxilla 2 broad at base, tapering to bilobed apex.

Maxilliped very broad, inner plate and palp reduced, the latter broad and apically rounded.

Peraeopods, anterior ones apparently not more strongly spinose in ♂ than in ♀; unguis either long and simple, or short with a vesicle below them. 7th peraeopod apparently not dimorphic.

Pleopod 1 without, pleopods 2–5 with rudimentary, pseudotracheae.

Uropod, peduncle neither channelled nor keeled on outer surface, inner ramus inserted proximally, outer ramus longer than inner.

On account of the bulbous epistome and the form of the maxilliped Budde-Lund considered that this genus should be placed in a distinct subfamily (1904, p. 36, and 1908, p. 298). The genus is known from Central and South America, West Indies, Comoro Islands, French Congo, and South West Africa. This distribution is interesting, especially as species with the long ungues and species with the short ungues and vesicles are found both in America and Africa.

Jackson has shown that the species of this genus are protandrous hermaphrodites, and that the external male genitalia are retained throughout life even in the female phase.

Rhyscotus bicolor Brnrd.

(Fig. 33.)

1924. *Rhyscotus bicolor*. Barnard, Ann. S. Afr. Mus., xx, p. 235.

1931. „ „ Brian, Rev. Suisse Zool., xxxviii, p. 435,
figs. 17-30 bis (var. *angolae*).

Surface regularly but somewhat sparsely granulate, on the pleon the granulation confined to the hind margins of the segments, with sometimes a faint additional transverse row across the middle of each segment. Epistome minutely rugulose.

Eyes with about 14 ocelli.

Postero-lateral angles of peraeon segments 1-3 rounded, 4 and 5 subquadrate, 6 and 7 acute.

Telson broader than long, sides strongly concave, apex acute.

Antenna 2, 5th joint longer than 4th, flagellum equal to 4th, its two joints subequal, usually the 1st slightly longer than 2nd.

Maxilla 1, only 4 (Nos. 1, 2, 3, 5) of the inner series of spines on outer lobe pectinate, the remaining one (No. 4) shorter and simple.

Peraeopods, distal margins of 3rd-5th joints with short stout close-set spines; ungues simple, long, without vesicles. Anterior peraeopods in ♂ not specially spinose, all the spines simple.

Penis widest at base, tapering evenly, the ventral surface sculptured with minute scabrosities.

Pleopod 1 in ♂, inner branch tapering to a slender point, inner margin minutely spinulose.

Uropod, peduncle oval in cross-section, distal margin externally with a small semicircular excision, inner ramus subequal to peduncle, outer ramus externally grooved.

Up to 12×4.5 mm. (σ). Slaty-grey, head and peraeon obscurely marked with more or less longitudinal light yellowish spots, postero-lateral angles of peraeon segments and the peduncle of uropod yellow, legs and 1st and 2nd joints (or 1st-3rd) of antennae pale yellow, outer branches of pleopods grey, outer ramus of uropod grey or pale yellow, eyes black. In some examples the whole of the peraeon is orange-yellow, and all gradations between the extreme colorations may occur.

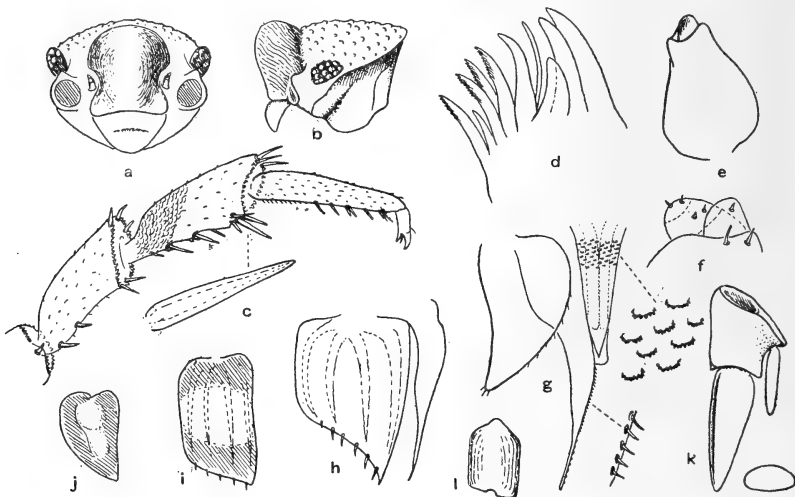


FIG. 33.—*Rhyscotus bicolor* Brnrd. a, b, Frontal and lateral views of head; c, distal joints peraeopod 1 σ , with spine further enlarged; d, apex of outer lobe of maxilla 1; e, maxilla 2; f, inner plate and palp of maxilliped; g, penis and pleopod 1 σ , with surface sculpturing of penis further enlarged; h, pleopod 2 σ ; i, j, 3rd and 5th pleopods; k, dorsal view of uropod, with cross-section of peduncle; l, outer view of peduncle of uropod.

Localities.—Ovamboland: Ongandjera and Kunene River (K.H.B.).

Kaokoveld: Warmbad and Zesfontein (R.F.L.); Kaoko

Otavi and neighbourhood (K. H. B.).

Damaraland: Belina, near Outjo (K. H. B.).

Angola: Vila da Ponte, Kubango River (Brian).

The species is common in the north-west of the Kaokoveld and Ovamboland regions of South West Africa, the most southerly and easterly locality being Outjo. Its nearest relative seems to be *globiceps* B-L. from Loango in the French Congo (fig. 39).

Of the numerous (nearly 100) specimens from the above localities all are males. Not being aware at the time of collection (Ovamboland, 1923; Kaokoveld, 1926) that the members of this genus exhibited protandry, I made no special examination of the specimens or search

for females. The largest ♂♂ are ripe, as is shown by the congealed mass of sperm on the penis and 1st pleopods, evidently squeezed out when the animals were put into alcohol.

The pseudotracheae in this species seem to be slightly different from those figured by Budde-Lund for *ortonedae* (1908, Voeltzkow, Reise, vol. ii, p. 17, figs. 24-28). On the 2nd-4th pleopods there are four tubular structures running subparallel from base to apex; on the 3rd and 4th pleopods there is an oval clear space in the middle of the appendage. In pleopod 5 there are two more or less distinct clear spaces, but no tubes. Whether these structures really are tubes, tracheal or vascular, could not be determined; the second one from the inside appears to be definitely a tube, while the others appear more like clear spaces.

FAM. ARMADILLIDIIDAE.

- 1885. *Armadilloidea*. Budde-Lund, Crust. Isop. Terr., p. 14.
- 1898. *Armadillidiidae*. Sars, Crust. Norw., ii, p. 187.
- 1904. *Armadillidae*. Budde-Lund, Rev. Crust. Isop. Terr., p. 96.
- 1910. *Armadilloidea*. Id., Sjöstedt, Kilimandjaro-Meru Exp., iii, pp. 8, 9, 10.
- 1910. *Armadillidiidae* or *Cubaridae*. Stebbing, Gen. Cat. S. Afr. Crust., p. 444.
- 1922. „ Wahrberg, Ark. Zool., xv, p. 195.

First antenna 3-jointed. Second antenna, sockets usually small, flagellum 2-3-jointed. Mouth-parts as in *Oniscidae*. Penis and pleopods as in *Oniscidae*. Five pairs of brood lamellae; cotyledons present (fig. 13). Uropods exposed, but short, not extending beyond telson and pleurae of last pleon segment, outer ramus if large inserted terminally, if small usually not inserted terminally.

As *Armadillidium* Brdt. apparently precedes *Cubaris* Brdt. (see Stebbing, Willey's Zool. Res., v, p. 649, 1900), the family must unfortunately follow the longer generic name, unless the structure of the uropod is considered important enough to justify two families.

In spite of Stebbing's exposition (*loc. cit.*, 1900) of the invalidity of *Armadillo* (as the name of a Crustacean), Budde-Lund not only uses the name in 1904, but in 1909 uses it as a subgenus with type *officinalis* Desm. This subgenus therefore needs renaming. Van Name (1920, p. 97, footnote) has stated that *Cubaris* as a subgenus must be used for the "typical Old World section" of the group. But Budde-Lund

has already used *Cubaris* for the subgenus of which *murinus* Brdt. is the type. It seems, therefore, as if *Pentheus* Koch might suit for the *officinalis* section (see Budde-Lund, 1885, p. 50 and 1904, p. 97), but I do not definitely propose this as I have had access to the works of neither Brandt nor Koch.

I consider, however, that Budde-Lund's subgenera may well be elevated to the rank of genera, in spite of certain forms which appear to be somewhat transitional and thus soften the sharp lines of demarcation drawn by Budde-Lund.

For example, *aenigma* and *cingulatus* (pp. 372, 373), which in structure of the head and number of mandibular penicils are forms of *Diploexochus*, have the very broad pronotum characteristic of *Bethalus* and *Cubaris*. On the other hand *macrodens* (p. 311) is a *Bethalus* as



FIG. 34.—Apex of left mandible of : *a*, *Bethalus* ; *b*, *Cubaris* ; showing in the one case a single free penicil, and in the other several penicils.

regards the head and mandible, but has an unusually narrow pronotum. It seems to me that the characters of the head and mandible are likely to be of greater phylogenetic significance than the width of the pronotum, in which there is every gradation from the very narrow, almost "linear" form (e.g. *officinalis*, *formicarum*), to the very broad form (*secutor*, *aenigma*) occupying one-quarter or even one-third of the dorsal length of the segment (see fig. 75, *e*).

In the following key, therefore, the importance of the pronotum is subordinated to the characters of the head and the mandible.

The character of the epimeron of the 1st peraeon segment also shows so many transitions from the typical *Bethalus* type (thin, expanded, with small, more or less rudimentary internal tooth) to that of *Diploexochus* (more or less thickened, with the outer margin of the internal tooth continued forwards as a raised line or ridge, thus forming a more or less extensive groove between it and the actual margin), that hard and fast divisions are not possible (*cf.*, e.g., the figures of *limbatus*, *barbertoni*, *macrodens*, *aenigma*, *nigricans*, *orphanus*).

The subdivision of the old "Cubaris" complex is therefore still

open to revision. But there is no doubt that the characters used by Budde-Lund are worthy of close examination, and the description of a species of "Cubaris," which omits all mention of the mandibular penicils and the pronotum, must be regarded as inadequate.

The position of some of the species described below I myself regard as unsatisfactory and subject to revision when further collecting has brought together more material.

Although included in the generic diagnoses, the groove on the anterior surface of the 5th joint of peraeopod 1 is a feature without much significance. It does not seem to have been mentioned before except by Wahrberg for *Buddelundia* (1922, p. 209), but occurs apparently throughout the family more or less conspicuously developed (*Armadillidium*, "Cubaris" *officinalis*, etc.), and in both sexes.

Key to the South African genera.

- I. The space between telson and pleura of 5th pleon segment filled by the peduncle of uropod, the outer ramus of which is narrow, terete, often very small, and inserted more or less on the internal margin of peduncle.
 - A. Telson triangular.
 1. Antennary tubercles combined with lateral lobes of frontal line (figs. 35, 36, 37).
 - a. Margin of peraeon segment 1 typically thickened, reflexed, and separated by a groove. Outer ramus of uropod inserted terminally *Periscyphis*.
 - b. Margin of peraeon segment 1 thin, not reflexed, not separated by a groove. Outer ramus of uropod inserted on inner margin of peduncle *Hekelus*.
 2. Antennary tubercles forming distinct raised ridges on epistome (fig. 38) *Exzaes*.
 - B. Telson more or less quadrangular or hour-glass shaped, apical margin broadly rounded or truncate. Antennary tubercles not distinct.
 1. Mandible with 1 free penicil (fig. 34, a).
 - a. Lateral marginal line of head disconnected from epistome (fig. 46). Pronotum broad, at least one-fifth (except *macrodens*) *Bethalus*.
 - b. Lateral marginal line continued on to epistome (fig. 77).
 - i. Pronotum broad.
 - a. Epimera discontinuous, margin of 1st thin *Akermania*.
 - β. Epimera contiguous, margin of 1st grooved throughout its length, hind corner cleft *Synarmadillo*.
 - ii. Pronotum usually narrow.
 - a. Postero-lateral corner of peraeon segment 1 not cleft *Polyacanthus*.
 - β. Postero-lateral corner of peraeon segment 1 cleft *Diploexochus*.

2. Mandible with several penicils (fig. 34, b).

- a. Pronotum broad *Cubaris*.
 b. Pronotum narrow *Anchicubaris*.

II. The space between telson and pleura of 5th pleon segment filled by the broad, spatulate outer ramus of uropod, attached terminally to the peduncle which is not (or scarcely) visible dorsally *Armadillidium*.

Synarmadillo Dollf. is included in the above key, as it occurs in tropical Africa and Madagascar, and has been found in the Belgian Congo (van Name, 1920). See Arcangeli, Atti Soc. It. Sc. Nat., lxvi, 1927.

Gen. PERISCYPHIS Gerst.

1873. *Periscyphis*. Gerstaecker, in von der Decken, Reise, iii, pt. 2, p. 525.
 1885. *Cercocytonus*. Budde-Lund, Crust. Isop. Terr., p. 42.
 1885. *Periscyphis*. *Id.*, *ibid.*, p. 293.
 1904. „ *Id.*, Rev. Crust. Isop. Terr., p. 37.
 1908. „ *Id.*, in Voeltzkow, Reise, ii, p. 278.
 1909. „ *Id.*, Res. Swed. Zool. Exp. White Nile, pt. 3, Terr. Isop., p. 10.
 1926. „ Omer-Cooper, Proc. Zool. Soc. Lond., p. 354 (revision of genus).
 1929. „ Arcangeli, Ann. Mus. Zool. Univ. Napoli, v, No. 23, p. 1.

Head concrete ; frontal marginal line usually interrupted in middle, feeble, sometimes complete ; antennary tubercles combined with frontal line. Eyes well developed.

Peraeon segment 1 with (except in two species and one n. sp. described below) margin thickened (Omer-Cooper : “girdle”) and separated from rest of segment by a more or less deep groove. Postero-lateral corner entire. Margins of segments 2 and 3 not thickened either dorsally or ventrally in typical species. Pronotum broad.

Pleurae moderately or well developed. Telson triangular, sides concave, apex acute.

Antenna 1, 3rd joint not elongate, with apical tuft of setae. Antenna 2, flagellum 2-jointed, 1st joint not shorter than 2nd in typical species. Mandible with one free penicil ; molar penicil a single strong, more or less branched, plumose seta. Maxilla 1, outer lobe with 4 + 5 (6) spines, all entire in typical species ; inner lobe with 2 rather long setae. Maxilla 2 broad, inner lobe small, outer lobe much

expanded, a small lobe below latter on outer margin. Maxilliped, inner plate spinose, palp slender, not drawn out into processes.

Peraeopods 1-3 or 4 (? in all species) in ♂ with strong fringe of spines on 4th and 5th joints. Peraeopod 7 with 3rd joint often more strongly expanded on anterior margin in ♂ than in ♀.

Pleopods 1 and 2 with pseudotracheae.

Uropod, peduncle large, outer edge flattened, thin, inner ramus inserted proximally, outer ramus small or minute, often inserted subterminally on dorsal surface.

Omer-Cooper has given a very valuable revision of this genus, which is entirely African in distribution, occurring chiefly in the north-eastern region but extending southwards to Nyasaland.

The first described South African species, by an unfortunate error, was attributed to the Eubeline genus *Periscyphops*, and thus was responsible for the institution of Brian's species. It conflicts with Omer-Cooper's diagnosis in one or two points. The margins of peraeon segments 1-3 are thickened ventrally, the 2nd and 3rd only slightly; the 1st flagellar joint of antenna 2 is much shorter than the 2nd; the inner series of spines on outer lobe of maxilla 1 comprises 6 spines, 3 of which are apically notched, 3 simple, one of the latter being shorter than the rest. Peraeopods 1-4 in the ♂ are strongly fringed; this may not actually be a difference, as Omer-Cooper only mentions peraeopod 1 as being strongly fringed and says no detailed study was made of the 2nd-6th peraeopods. The spines composing these fringes are of a different shape from those of *trivialis* figured by Omer-Cooper; this may be only a specific character.

On account of the above differences it seems advisable to separate *kunenensis* from the typical species of *Periscyphis*, though it may be doubted whether the differences should be accorded more than subgeneric value.

For remarks on the brood-pouch, and an objection to Omer-Cooper's terminology, see *supra*, p. 225.

Key to the South African species.

1. Antenna 2, flagellar joints subequal, or 1st longer than 2nd. Maxilla 1, inner spines of outer lobe simple *Periscyphis*.
 Girdle absent *chindeensis*.
2. Antenna 2, 1st joint much shorter than 2nd. Maxilla 1, some of the inner spines on outer lobe trifid. *Angaribia*.
 Girdle present, well developed *kunenensis*.

Periscyphis chindeensis n. sp.

(Fig. 35.)

Surface smooth, minutely granulate. Head with marginal line continued round lower margin of eye on to lateral lobes and across the front, but frontal line not raised or even strongly marked.

Peraeon segment 1, girdle completely absent, margin not thickened, postero-lateral corner as in *kunenensis* (fig. 36); segments 2 and 3 with margin not thickened. Pronotum $\frac{1}{2}$.

Telson broader than long, sides deeply concave, apex subacute.

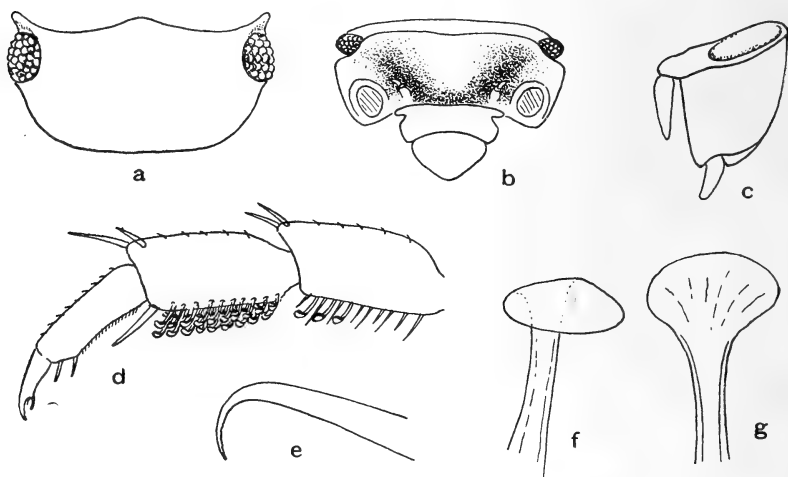


FIG. 35.—*Periscyphis chindeensis* n. sp. a, b, Dorsal and frontal views of head; c, uropod; d, peraeopod 1 ♂; e, f, g, three views of spines from 5th joint of peraeopods 1-3 ♂.

Antenna 2, 5th joint $1\frac{3}{4}$ times 4th, flagellum $\frac{3}{4}$ length of 5th joint, the two flagellar joints subequal.

Maxilla 1 typical, outer lobe with 4+5 spines, all the latter simple. Peraeopods 1-3 in ♂, 5th joint with strong apically expanded and hooked spines set in 3 rows on lower margin, lower apex of 4th joint also with 2-3 similar spines in peraeopods 1 and 2, but not in peraeopod 3.

Pleopod 1 ♂ as in *vittatus* Omer-Cooper.

Uropod, peduncle with basal width greater than length, inner ramus not nearly reaching inner distal angle of peduncle, outer ramus about $\frac{2}{3}$ length of inner, inserted terminally.

7.5 × 4 mm. Yellowish-white, a very faint dark median stripe

(mainly due to the gut showing through), and a series of obscure dark oval or subtriangular spots laterally (at position of junctions of epimera), one on each of peraeon segments 1-7 and pleon segments 3-5, antennae and legs pale, eyes black.

Locality.—Portuguese East Africa : Chinde, mouth of the Zambezi River (K. H. B., 1912).

The single ♂ specimen was found in the sand dunes near the shore.

In the absence of a girdle or any groove on peraeon segment 1 this species resembles *vittatus* Omer-Cooper and *civilis* B-L., but the head is like that of *latissimus* Omer-Cooper. As regards the flagellum of antenna 2 and maxilla 1 it is a typical *Periscyphis*. The most remarkable feature is the expanded and hook-like spines on the anterior peraeopods. They are so different from those of *trivialis* as figured by Omer-Cooper, and *kunenensis*, that it appears quite likely that the spines on the anterior peraeopods of the ♂ might afford specific characters ; Omer-Cooper did not specially examine this feature.

Angaribia subgen. n.

Peraeon segments 1-3 with the margins ventrally thickened.

First joint of flagellum of antenna 2 much shorter than 2nd joint. Maxilla 1, outer lobe with some of the spines of the inner series apically notched (trifid).

Peraeopods 1-4 strongly fringed in ♂ with trifid spines.

The name is taken from the Arabic : angarib, a couch, in allusion to the flat brood-lamellae on which the eggs and embryos lie, though this feature is found throughout the Armadillidiid series (cf. p. 225).

Periscyphis (*Angaribia*) *kunenensis* (Brnrd.).

1924. *Periscyphops kunenensis*.^{Fig. 35} Barnard, Ann. S. Afr. Mus., xx,
p. 231.

1931. *Periscyphis monardi*. Brian, Rev. Suisse Zool., xxxviii,
p. 430, figs. 1-16 bis.

Surface smooth, minutely granulate. Head with marginal line continued round lower margin of eye on to lateral lobe, but not continuous across front ; front with a median vertical low rounded ridge ; limits of frontal and dorsal parts of head clearly defined, but without any actual line except immediately next the eye where there is a slight transverse impression. Upper margin of clypeus well marked, slightly notched medianly.

Girdle well developed, without any anterior depression (*i.e.* it is convex right around to the anterior margin), extending nearly to postero-lateral corner of segment; margin of segment 1 thickened ventrally as well as dorsally; antero-lateral margins of segments 2 and 3 slightly thickened ventrally. Pronotum $\frac{1}{3}$.

Telson about as broad as long, apex rounded, but not broadly, sides strongly concave.

Antenna 2, 5th joint $1\frac{1}{2}$ times 4th, flagellum shorter than 5th joint, its 1st joint one-half length of 2nd.

Maxilla 1, three (Nos. 1, 3, 4) of the six spines of inner series on outer

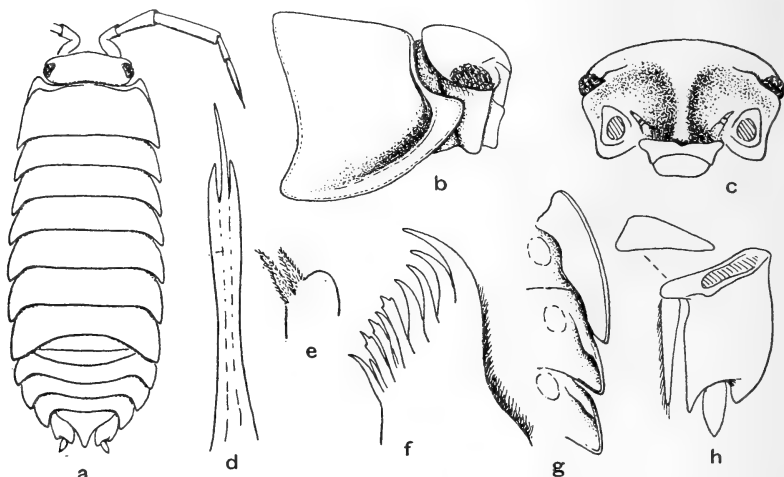


FIG. 36.—*Periscyphis* (subgen. *Angaribia* n.) *kunenensis* (Brnrd.). *a*, Whole animal; *b*, side-view of head and peraeon segment 1; *c*, front view of head; *d*, spine from peraeopod 1; *e, f*, apices of inner and outer lobes of maxilla 1; *g*, ventral surface of peraeon segments 1-3; *h*, dorsal view of uropod, with cross-section of peduncle, dorsal surface above, outer margin to right.

lobe apically notched, trifold, the 5th spine shorter than the others; inner lobe with outer distal angle rather strongly rounded. Maxilla 2 and maxilliped as in Omer-Cooper's figs. 10-12.

Peraeopods 1-4 ♂, 4th and 5th joints strongly spinose, the spines apically trifold, the median point much longer than the others.

Pleopod 1 ♂ as in *undulata*, Omer-Cooper's fig. 41. Pseudotracheae on pleopods 1 and 2 very rudimentary.

Uropod, peduncle longer than broad, inner distal angle projecting beyond outer angle, inner ramus extending nearly to inner distal angle of peduncle, outer ramus terminal, one-half length (or nearly) of inner ramus.

Up to $10-11 \times 4$ mm. (♂♂ smaller than ♀♀). Slaty-grey with faint lighter marks dorsally, arranged more or less in two series, usually a pale spot laterally on each peraeon segment at position of junctions of epimera, legs and first 3 joints of antennae pale, uropods pale orange, eyes black.

In the Kaokoveld specimens the dorsal light marks are more or less confluent into large light patches; in some specimens the light colour predominates, but the pleon is nearly always uniformly dark, though the pleurae of segment 5 are pale sometimes. There is one completely pale (albino) ♀ from Kaoko Otavi, even the eyes being brown instead of black.

Localities.—Ovamboland: Kunene River and Mafa (Barnard).

Kaokoveld: Kamanyab and Kaoko Otavi (K. H. B., 1926).

Angola: Vila da Ponte, Rio Mbalé, Kubango River (Brian).

This species has several points of likeness to the Abyssinian *undulata* Omer-Cooper, thus the girdle, shape of telson, uropods, and pleopod 1 in ♂.

The Kaokoveld specimens are larger and more strongly mottled than those collected in Ovamboland.

Hekelus n.g.

Head concrete; lateral marginal line continued past eyes on to lateral lobes of frontal line, which in front view is strongly declivous laterally, and interrupted in middle by a raised cuneiform narrow shield. Antennary tubercles combined with lateral lobes of frontal line.

Epimera contiguous, margin of 1st thin, not reflexed. Hind margin of peraeon segment 1 sinuous. Pronotum very broad. Pleon rather narrow. Telson triangular.

Antenna 2 with 2-jointed flagellum. Mandible with a single free penicil. Maxilla 1 with some of the inner spines on outer lobe bifid, inner lobe apically scarcely wider than the bases of the 2 subequal slender and elongate plumose setae. Maxilliped with spinulose inner plate, and palp without setose processes.

Peraeopod 1 with groove on anterior surface of 5th joint.

Uropod, peduncle broad, proximally, apically narrowing, outer ramus cylindrical, rather stout, inserted on inner margin, inner ramus long.

The head seems to bear most resemblance to that of *Scleropactes* (Jackson, 1928, fig. 16), one of the Spherillonine genera. There is a certain similarity to *Adinda* B-L. (of which *Paraperiscyphis* Stebb. is a synonym) in the uropod, but the maxilliped has no setose processes on the palp.

Hekelus episimus n. sp.

(Fig. 37.)

Body rather narrow, strongly convex. Surface minutely granulate. Rugae distinct. Head strongly convex dorsally, with 2 shallow grooves from posterior margin converging forwards and petering out

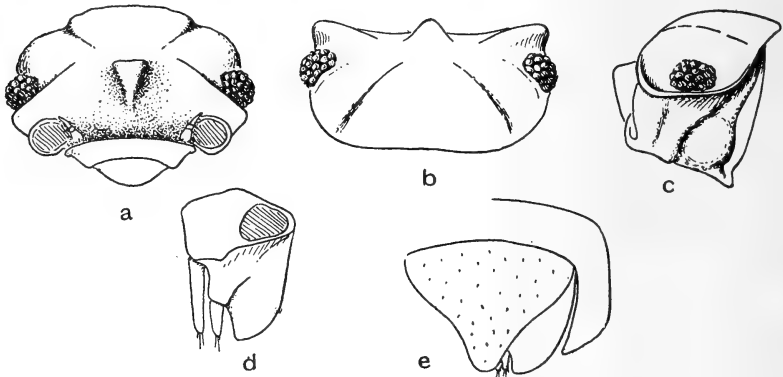


FIG. 37.—*Hekelus episimus* n.g., n. sp. a, b, c, Frontal, dorsal, and lateral views of head; d, dorsal view of uropod; e, telson.

before reaching the projecting cuneiform process on epistome. Eyes rather large, 18–20 ocelli.

Peraeon segment 1 with epimeral margin thin, subvertical, not reflexed. No internal lamina or tooth on either segment 1 or 2.

Pronotum of segment 2 one-third, of posterior segments nearly one-half the dorsal length of segment.

Pleon rather narrow, pleurae slender. Telson triangular, broader than long, apex narrowly rounded, dorsally unsculptured, strongly convex proximally, less so distally.

Antenna 2, 2nd joint slightly broader and shorter than 4th, 5th $1\frac{1}{2}$ times 4th, flagellum equal to 4th joint, its 2nd joint 2– $2\frac{1}{2}$ times 1st.

Tracheal areas on pleopods small.

Uropod, peduncle oblong, stout proximally, narrowing distally to an asymmetrically rounded apex which projects beyond apex of pleurae of pleon segment 5, outer ramus extending almost to apex

of peduncle, inner ramus long, extending to level of apex of outer ramus and almost to apex of telson.

7 × 2.75 mm. Dark slaty-grey, sometimes, especially in young, with a series of paler spots at junctions of epimera, eyes black, antennae and legs slaty-grey.

Localities.—Cape Province: Table Mt. and Kalk Bay Mt., Cape Peninsula (K. H. B.); Noordhoek Forest, Cape Peninsula (K. H. B.).

The Noordhoek Forest (altitude 500 ft.) specimens have a more narrowly pointed telson, and are definitely mottled; but otherwise they are not distinguishable from the specimens from higher altitudes.

This woodlouse lives amongst leaves and humus in the forest and bush-filled kloofs on the mountain slopes.

Exzaes n.g.

Head concrete; antennary tubercles forming distinct ridges over the antennal sockets; epistome with a median triangular raised shield.

Peraeon segment 1 with epimeral margin reflexed, hind corner cleft. Segment 2 with ridge on lower surface near anterior margin, but no tooth. Pronotum very broad. Telson triangular.

Antenna 2 with 2-jointed flagellum. Mandible with a single free penicil. Maxilla 1 with 9 spines on outer lobe, 3 or 4 of the inner ones feebly bifid, inner lobe with 2 slender subequal plumose setae, outer apex of lobe rounded.

Peraeopod 1 with feeble groove on anterior surface of 5th joint.

Uropod, peduncle oblong, outer ramus well developed, cylindrical, inserted dorsally near inner margin, inner ramus long.

This genus closely resembles *Armadillidium* in the structure of the head (cf. Jackson, 1928, p. 592, fig. 19), but the upper margin of the median shield is continuous with the frontal line, which meets the eye but does not form projecting lateral corners in front of the eye.

Both the species described below live in the bush and forest in sheltered (εξ-ζαῖς) kloofs of the mountains.

Exzaes sylvatica n. sp.

(Fig. 38, a-g.)

Surface strongly squamulose, scale-spines triangular, broad and short. Rugae obsolete. Eyes with 9–10 ocelli.

Peraeon segment 1, margin reflexed, slightly costate, not grooved, hind corner unequally cleft. Segment 2, epimeron with a distinct

rounded ridge, but no projecting or free tooth. Pronotum of segment $2\frac{2}{3}-1\frac{1}{3}$, of posterior segments $\frac{1}{2}-\frac{2}{3}$ of dorsal length.

Telson slightly broader than long, sides slightly concave, apex subacute, dorsally smoothly convex, no median ventral groove.

Antenna 2, 2nd and 4th joints subequal, 5th $1\frac{1}{2}$ times 4th, flagellum three-quarter length of 5th, its 2nd joint 3-4 times 1st.

Uropod, peduncle longer than wide, outer distal corner rounded, outer ramus extending to apex of peduncle, inner ramus long, projecting a little distance beyond telsonic apex.

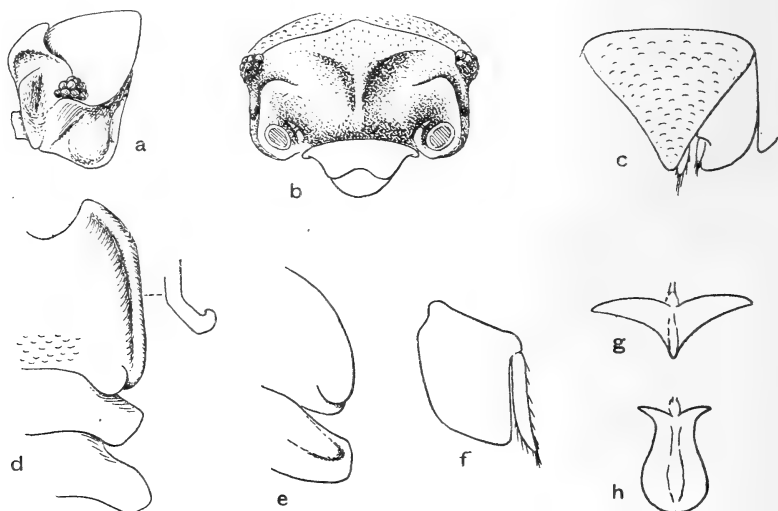


FIG. 38.—*Exzaes sylvatica* n.g., n. sp. a, b, Lateral and frontal views of head; c, telson; d, dorsal view of peraeon segments 1-3; e, ventral view of peraeon segments 1 and 2; f, ventral view of uropod; g, scale-spine. *Exzaes bicolor* n. sp.: h, scale-spine.

Tracheae occupying one-third (at most) of the pleopods.

5×2 mm. Pale slaty-grey, uniform, eyes black.

Localities.—Cape Province: Knysna Forest (J. D.); George Forest (K. H. B.).

Exzaes bicolor n. sp.

(Fig. 38, h.)

Distinguished from *sylvatica* as follows: eyes larger, with 12-14 ocelli, scale-spines obovate, longer than wide, apically rounded, and coloration.

9×3.5 mm. Slaty-grey, mottled with dull orange or yellowish, head almost always orange or yellow, rarely suffused medio-dorsally,

eyes black, legs pale greyish, peduncle of antennae grey, flagellum white.

Locality.—Cape Province: Oudebosch Forest, River Zonder End Mts. (K. H. B.).

Gen. BETHALUS B-L.

1904. *Armadillo* (part). Budde-Lund, Rev. Crust. Isop. Terr.,
pp. 97, 127 (Section vii).
1900. „ „ *Id.*, in Voeltzkow, Reise, ii, p. 275.
1909. *Bethalus*. *Id.*, in Schultze, Reise, ii, p. 54 (subgen. of
Armadillo).
1910. „ „ *Id.*, Sjöstedt, Kilimandjaro-Meru Exp.,
iii, p. 12.

Head concrete, antennary tubercles not distinct, epistome without median raised shield, but separated from dorsal surface of head by a

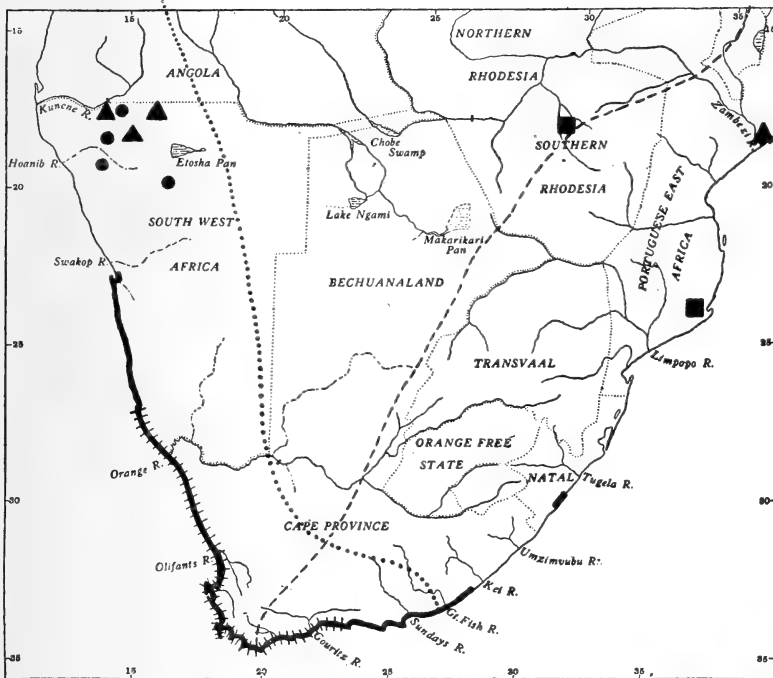


FIG. 39.—Chart showing the recorded distribution of the following genera. *Tylos* indicated by thickened coast-line, *Deto* by cross-lines on the coast, *Rhyscotus* by ●, *Periscyphis* by ▲. *Bethalus* occurs east of the broken line, and also in Madagascar. *Niambia* occurs west of the dotted line; the subgenus *Manibia* occurs in two localities marked by ■.

more or less deep groove, lateral marginal line not continued on to epistome (fig. 46).

Epimera large and thin; on segment 1 reflexed, not grooved, hind corner not cleft; internal tooth or fold usually small, often very small, tooth on segment 2 sometimes obsolete. Hind margin of segment 1 sinuate.

Pronotum occupying at least $\frac{1}{3}$ of dorsal surface (except in *macrodens*).

Antenna 2 with 2-jointed flagellum. Mandible with a single free penicil. Maxilla 1, inner lobe with 2 slender subequal plumose setae, outer apex rounded.

Peraeopod 1 with groove on anterior surface of 5th joint.

Uropod, peduncle oblong, subquadrate, or subtriangular, inner and outer rami well developed, both cylindrical.

Genotype: *nigrinus* B-L.

In 1909 Budde-Lund excluded *emunitus* (from Siam) from his Section vii. If we exclude also *tenuipunctatus* and *depressus* (both from St. Vincent, W.I.), which Budde-Lund doubtfully placed in this section in 1904, the genus is seen to be confined to South Africa and Madagascar. In Budde-Lund's MSS. in the British Museum four more Madagascan species are included in the genus.

The distribution in South Africa (fig. 39) is interesting in comparison with that of the allied Cubarid genera.

Key to the South African species.

- I. Epistome not strongly raised above dorsal level of head (fig. 43). Postero-lateral corner of peraeon segment 1 rounded.
 - A. Internal tooth on peraeon segment 2 small, usually not extending to margin.
 1. Telson coarctate.
 - a. Inner ramus of uropod short.
 - i. Telson with two tubercles and a median keel *limbatus*.
 - ii. Telson nearly smooth.
 - a. Without rugae. Tooth on segment 2 very small *pretoriensis*.
 - β. With rugae. Tooth on segment 2 larger *rhodesiae*.
 - b. Inner ramus of uropod long *panurus*.
 2. Telson not or scarcely coarctate.
 - a. Telson with 2 tubercles at base of median keel . *cordatus*.
 - b. Telson without tubercles at base.
 - i. Telson medianly keeled.
 - a. Distal portion of telson longer than wide *nigrinus*.
 - β. Distal portion of telson at least as wide as long *tradouwi*.
 - ii. Telson smooth *stricticauda*.

B. Internal tooth on segment 2 stronger.

1. Tooth on segment 2 not extending to antero-lateral margin. Internal lamina on segment 1 strong *macrodens*.
2. Tooth on segment 2 extending to margin, and partially visible externally in lateral view *barbertoni*.

II. Epistome strongly raised (fig. 46). Postero-lateral corner of segment 1 subtruncate.

A. Peraeon segments without medio-dorsal posterior processes.

1. Peduncle of uropod not narrowed distally, filling up the space between telson and pleura of 5th pleon segment *mucidus*.
2. Peduncle of uropod strongly narrowed apically, leaving a gap between telson and 5th pleon segment *warreni*.

B. Peraeon segments with medio-dorsal pointed process on hind margin of at least one segment.

1. Processes on all segments *secutor*.
2. A short process on 7th segment only, or on 6th and 7th *barnardi*.

Bethalus limbatus (Brdt.).

(Fig. 40, a-c.)

- | | | |
|-------|-----------------------------|-----------------------------------------------------------------|
| 1833. | <i>Cubaris limbata</i> . | Brandt, Conspect., xxviii, p. 4,
pl. iv, fig. 18. |
| 1885. | <i>Armadillo limbatus</i> . | Budde-Lund, Crust. Isop. Terr.,
p. 39. |
| 1895. | „ <i>griseo-albus</i> . | Dollfus, Mem. Soc. Zool. Fr., viii,
p. 347, fig. 5. |
| 1904. | „ <i>limbatus</i> . | Budde-Lund, Rev. Crust. Isop.
Terr., p. 128, pl. x, fig. 33. |

Surface minutely granulate (the apparent granulation really formed by minute transverse impressions). Rugae on head and peraeon segments feeble. Epistome not strongly raised.

Peraeon segments 1 and 2 both with feeble internal tooth. Segment 7 very slightly thickened below (Budde-Lund).

Telson a little broader than long, apical margin convex, sides incurved, dorsally with 2 rounded tubercles at base, followed by a low median ridge; a feeble median impression ventrally.

Antenna 2 slender, 2nd joint of flagellum 3-4 times length of 1st.

Uropod, peduncle subquadangular, outer ramus short, inner ramus short, $1\frac{1}{2}$ times length of outer ramus, extending scarcely midway to apex of telson.

10 × 5 mm. Slaty grey, with pale flecks dorso-laterally; sometimes variously mottled, the epimera and especially the pleurae often pale; uropods usually orange or dull reddish.

Localities.—Cape Province: Cape Town and Port Elizabeth (Budde-Lund); Matjesfontein (Dollfus, also W. F. P. and R. M. L.); Port Elizabeth (S.A. Mus., per J. L. Drege); Zwartkops, near Port Elizabeth (K. H. B.); Uitenhage (K. H. B.); Addo Bush (J. D.); Vogelfontein, Prince Albert Div. (A. J. H.); Drielings Kloof, between Laingsburg and Ladismith (K. H. B.); Beaufort West (W. F. P.); Victoria West (A. H. H.); De Aar (W. F. P.); Naauwpoort (W. F. P.); Hanover (W. F. P.); Cradock (W. F. P.); Laingsburg (W. F. P.); Montagu (W. F. P.); Knysna (R. M. L.); Mossel Bay (W. F. P.); Zwartberg Pass, Prince Albert (W. F. P.); Seven Weeks Poort and Meiringspoort, Zwartberg Range (K. H. B.); Doorn River, north of Montagu Pass, Oudtshoorn Dist. (S. H. H. and C. T.); Richmond (L. D. B. and C. T.); Fort Brown (Albany Mus.); Rosmead (Albany Mus.); Grahamstown (Albany Mus.).

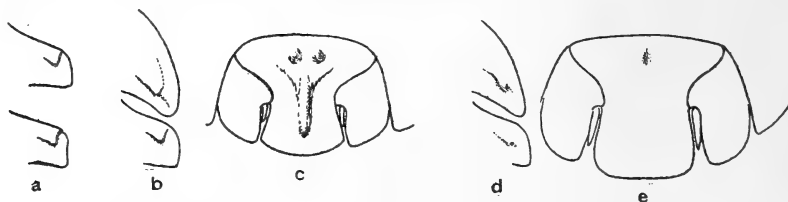


FIG. 40.—*Bethalus limbatus* (Brdt.). *a*, Two varieties of internal tooth on epimeron 2; *b*, ventral view of epimera 1 and 2; *c*, telson and uropods. *B. pretoriensis* (Dollf.): *d*, ventral view of epimera 1 and 2; *e*, telson and uropods.

Although there appears to be an appreciable difference in the figures of the telson given by Budde-Lund and Dollfus, *griseo-albus* seems to be undoubtedly synonymous with *limbatus*. I have compared Port Elizabeth specimens sent to the South African Museum by J. L. Drege with Budde-Lund's specimen in the British Museum, and have also examined numerous specimens from Matjesfontein, the type locality of *griseo-albus*. Dollfus says the length of the telson is greater than its width, but his figure shows the length exactly equal to the (visible) width. Normally the length is slightly less than the width, but not quite so much less as in Budde-Lund's figure.

In all the specimens I have seen, even those from Port Elizabeth, the fold (Budde-Lund: *duplicatura*) on the under side of the 7th epimeron is obsolete; perhaps Budde-Lund is referring to the faint longitudinal (*i.e.* parallel with lateral margin) ridge found on the under side of the 3rd–7th epimera in many species (*cf.* fig. 46, *mucidus*).

The Knysna specimens differ slightly in having the internal teeth on segments 1 and 2, especially that on segment 1, rather more

strongly developed; that on segment 1 is flanked on the outside by an indication of a thickening similar to that in *barbertoni* (fig. 45), but less conspicuous. In other respects the specimens are typical.

In some specimens, chiefly among those from the more northeasterly localities (e.g. Victoria West, Richmond), the tooth on segment 2 extends to the antero-lateral margin, or even overlaps it very slightly, as in *barbertoni* (fig. 45).

When identifying specimens reference should be made to *Diploexochus disjunctus*, which at first sight is very similar in appearance.

Bethalus pretoriensis (Dollf.).

(Fig. 40, d, e.)

1895. *Armadillo pretoriensis*. Dollfus, Mem. Soc. Zool. Fr., viii, p. 348, fig. 7.

1904. „ „ Budde-Lund, Rev. Crust. Isop. Terr., p. 130, pl. x, fig. 34.

Surface minutely granulate. Rugae indistinct. Epistome not strongly raised, in front view with a faint median V-shaped impression above, bounded below by a more or less distinct ridge.

Peraeon segments 1 and 2 with small internal teeth. Segments 5-7 not thickened on under surface.

Telson as long as basal width or a little longer, sides slightly incurved, apical margin almost straight, dorsally smooth with a very slight and inconspicuous median impression near base; ventrally with median groove.

Antenna 2 slender, 2nd joint of flagellum 3-4 times length of 1st.

Uropod, peduncle distally subquadrate, outer angle bevelled off, outer ramus moderately long, inner ramus a little longer than outer ramus, extending midway, or a little farther, to apex of telson.

8 × 4 mm. Grey, mottled laterally, with margins of peraeon and pleon often pale reddish, uropods red.

Localities.—Transvaal: Pretoria (Dollfus); Johannesburg and Modderfontein (W. F. P.); Junction of Marico and Crocodile Rivers (R. W. E. T.).

Bechuanaland: Vryburg (Dollfus).

Bethalus rhodesiae n. sp.

(Fig. 41, a, b.)

Surface minutely granulate. Rugae distinct. Epistome not strongly raised, with a shallow V-shaped median impression above.

Internal tooth on segment 1 small; that on segment 2 larger, extending nearly but not quite to antero-lateral margin, and not visible in external view. Segments 5-7 not thickened below.

Telson a little broader than long, apical margin slightly convex, sides incurved, dorsally with very faint median elevation; ventrally with median groove in basal half.

Antenna 2 moderately slender, 2nd joint of flagellum 3-4 times 1st. Uropod, peduncle apically subquadrate, outer ramus extending a little

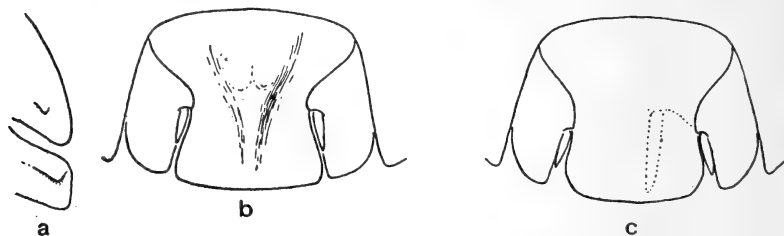


FIG. 41.—*Bethalus rhodesiae* n. sp. a, Ventral view of epimera 1 and 2; b, telson and uropods. *B. panurus* (B-L.); c, telson and uropods, from Budde-Lund's type of specimen in the British Museum.

more than half-way to apex of peduncle, inner ramus a little more than half length of peduncle, extending $\frac{2}{3}$ distance to apex of telson.

6 × 2.5 mm. In alcohol dark slaty-brown, uropods light (probably red in life).

Localities.—Rhodesia: Umtali (S.A. Mus.); Bulawayo and Salisbury (R. W. E. T.); Sanyati Valley (S.A. Mus.).

Distinguished from *pretoriensis* by the tooth on segment 2 and the more distinct rugae; and from *barbertoni* by the teeth on both segments 1 and 2.

Bethalus panurus (B-L.).

(Fig. 41, c.)

1904. *Armadillo panurus*. Budde-Lund, Rev. Crust. Isop. Terr., p. 131.

Surface minutely granulate. Rugae obsolete. Epistome not strongly raised, very faintly impressed medio-dorsally.

Internal tooth on segment 1 small and feeble; that on segment 2 almost obsolete.

Telson scarcely broader than long, apical margin slightly convex, sides slightly incurved, dorsal surface smoothly convex.

Uropod, outer ramus extending nearly to apex of peduncle, which

is obtusely rounded, inner ramus long, extending almost to apex of telson.

7 × 3.3 mm.

Locality.—Natal (Budde-Lund).

The obsolete rugae and smoothly convex telson are included in the above description from an inspection of Budde-Lund's type in the British Museum. I have seen no other examples.

Bethalus cordatus (Dollf.).

(Fig. 42.)

1895. *Armadillo cordatus*. Dollfus, Mem. Soc. Zool. Fr., viii, p. 349, fig. 8.

1904. „ „ Budde-Lund, Rev. Crust. Isop. Terr., p. 129.

Surface granulate. Rugae distinct, forming on each peraeon segment a continuous transverse series. Epistome not strongly raised, with 2 granules bordering a shallow median impression.

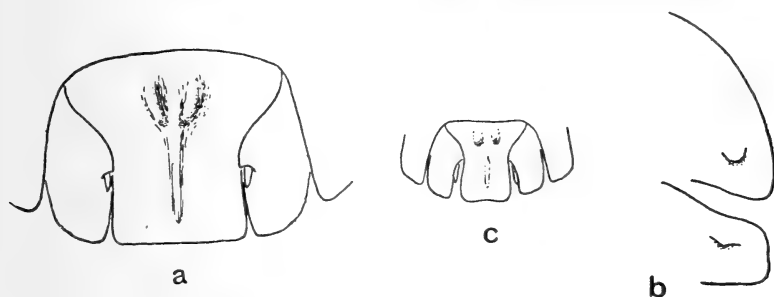


FIG. 42.—*Bethalus cordatus* (Dollf.). *a*, Telson and uropods of East London specimens; *b*, ventral view of epimera 1 and 2 of East London specimens; *c*, telson and uropods of Bloemfontein specimen (after Dollfus).

Internal teeth on segments 1 and 2 small, that on segment 2 obscure.

Telson slightly broader than long or about as broad as long, sides scarcely incurved, apical margin straight (in Dollfus' figure slightly concave), dorsally with 2 strong longitudinally elongate tubercles near base followed by a median longitudinal keel.

Antenna 2, 2nd joint of flagellum 3 times 1st.

Uropod, peduncle subquadrangular, but outer distal angle rounded, outer ramus short, extending $\frac{1}{3}$ distance to apex of peduncle, inner ramus extending $\frac{1}{2}$ — $\frac{2}{3}$ distance to apex of telson.

Up to 7×3 mm. (Dollfus : 4×1.75 mm.). In alcohol, grey-brown, uropods red.

Localities.—Orange Free State : Bloemfontein (Dollfus).

Cape Province : East London (R. M. L.).

The East London specimens are so like Dollfus' description and figure that I think they must be identified with his species ; they differ in the slightly shorter telson and the outer ramus of uropod.

Bethalus nigrinus (B-L.).

(Fig. 43, a, b.)

1885. *Armadillo nigrinus*. Budde-Lund, Crust. Isop. Terr., p. 37.

1904. „ „ *Id.*, Rev. Crust. Isop. Terr., p. 131, pl. x, figs. 35, 36.

1917. *Cubaris reticulatus*. Collinge, Ann. Nat. Mus., iii, p. 570, pl. xl, figs. 11–21.

1920. „ „ *Id.*, *ibid.*, iv, pl. xxvii, fig. 2 (figure shows 8 peraeon segments).

1917. *Cubaris longicauda*. *Id.*, *ibid.*, iii, p. 574, pl. xli, figs. 21–31.

1920. „ „ *Id.*, *ibid.*, iv, pl. xxvii, fig. 5 (figure shows only 6 peraeon segments).

Surface minutely granulate. Rugae moderately distinct but not strong. Epistome not strongly raised, evenly convex, slightly sloping backwards above.

Internal teeth on segments 1 and 2 very small and inconspicuous, mere granules. Segments 5–7 not transversely thickened below.

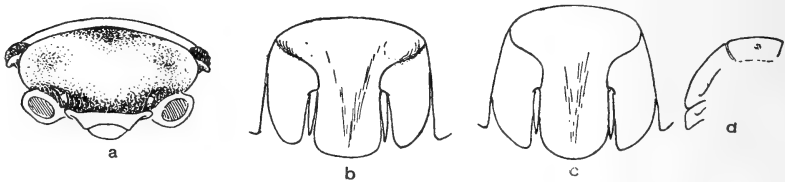


FIG. 43.—*Bethalus nigrinus* (B-L.). a, Front view of head ; b, telson and uropods. *B. stricticauda* (Dollf.) : c, telson and uropods from specimen in Budde-Lund collection in British Museum ; d, ventral view of epimera 1 and 2, after Dollfus.

Telson scarcely broader than long, distal portion subrectangular, longer than broad, apical margin slightly convex, sides scarcely incurved, dorsally with slight median longitudinal ridge or keel ; ventrally with median groove.

Antenna 2, 2nd joint of flagellum 2-3 times 1st.

Uropod, peduncle narrowing distally, apex narrowly rounded, not always completely filling the space between telson and 5th pleon segment, outer ramus rather long, but not quite reaching apex of peduncle, inner ramus long, scarcely reaching apex of telson.

Up to 12-14 × 6-7 mm. Slaty-grey, or brownish, often more or less reticulated, with pale dorso-lateral flecks, or mottled, epimera and uropods often pale.

Localities.—Cape Province: Cape Town and Port Elizabeth (Budde-Lund); Pondoland (Budde-Lund MSS.); Port Alfred (Collinge, and Albany Mus.); East London (W. F. P. and R. M. L.); Port St. Johns (S.A. Mus.); Grahams-town (W. F. P., and Albany Mus.); Fort Brown (Albany Mus.); Amatola Mts. (W. F. P.); Knysna (W. F. P. and R. F. L.); Keurbooms River (K. H. B.); Wilderness, near George (S. H. H. and C. T.); Kaaimansgat, near George (K. H. B.); Pacaltsdorp (S.A. Mus.); Bredasdorp (R. F. L.).

Natal: Pietermaritzburg (Collinge); Durban, Inchanga, and Krantzkop (K. H. B.); Port Edward, near Port Shepstone (Natal Mus.); M'fongosi, Zululand (S.A. Mus.).

Portuguese East Africa: Masiene (R. F. L.).

In 1885 Budde-Lund gave the locality as "Cape of Good Hope" with a query, probably collected by Drege; in 1904 he gave the above more exact localities without, however, indicating the source of his new material (if it was new material). I very much doubt the occurrence of the species anywhere near Cape Town.

The distal portion of the telson is often slightly broader than in Budde-Lund's 1904 figure, and the peduncle of uropods is broader, filling up nearly the whole space between the telson and 5th pleon segment. I have seen an example from Port Alfred, and find the anterior "raised lateral bosses" mentioned by Collinge are non-existent; the deceptive appearance as shown in Collinge's fig. 31 is due to a couple of pale spots.

There is some slight variation in the width of the distal portion of the telson, even in specimens from the same locality, and the keel on the telson tends to be sharper and more distinct in examples from the eastern localities than in those from the western districts. But no hard and fast distinction can be found sufficient to justify keeping

either *reticulatus* or *longicauda* as a variety. Budde-Lund's figure does not show the keel on the telson.

As far as can be judged from the present known localities, this species appears to be a coastal species, though it occurs inland at Grahamstown and the Amatola Mts. At Keurbooms River and the localities near George it is found under logs and in the bush on the sand-dunes bordering the shore.

I have seen specimens labelled *reticulatus* in Collinge's handwriting from the type locality *ex* Natal Museum. They prove to be indistinguishable from *nigrinus* (and *longicauda*!), and show that Collinge's figs. 18 and 21 have been badly executed. The internal tooth on segment 1 is represented as too large and too near the lateral margin, and the apical portion of the telson as too stumpy.

Bethalus tradouwi n. sp.

(Fig. 44, d, e.)

Surface minutely granulate. Rugae moderately distinct. Epistome not strongly raised.

Epimeral margin of segment 1 reflexed, under-surface tumid but not so strongly as in *macrodens*, internal tooth moderate, traceable to about half-length of lateral margin. Internal tooth on segment 2 strong, nearer anterior margin than in *macrodens*.



FIG. 44.—*Bethalus macrodens* n. sp. a, Telson and uropods; b, marginal view of epimeron 1; c, ventral view of epimera 1 and 2. *B. tradouwi* n. sp.: d, ventral view of epimera 1 and 2; e, telson and uropods.

Telson broader than long, distal portion broader than long, sides not incurved, apical margin straight, dorsally with slight median ridge.

Antenna 2, 2nd joint of flagellum 4 times 1st.

Uropod, peduncle narrowing distally, outer ramus extending half-way to apex of peduncle, inner ramus extending half-way to apex of telson.

6 × 3 mm. Slaty-grey, variegated with lighter.

Localities.—Cape Province : Langeberg Mts. at Tradouw Pass and Riversdale (K. H. B.).

As regards the internal tooth on segment 1 this species occupies a position intermediate between *limbatus* and *macrodens*, but the quadrangular distal portion of the telson is distinctive.

Bethalus stricticauda (Dollf.).

(Fig. 43, c, d.)

1895. *Armadillo stricticauda*. Dollfus, Mem. Soc. Zool. Fr., viii, p. 348, fig. 6.

1904. „ „ „ Budde-Lund, Rev. Crust. Isop. Terr., p. 132, pl. x, figs. 37, 38.

Epistome not strongly raised, with a low median tubercle.

Internal teeth on segments 1 and 2 small.

Telson longer than wide, distal portion longer than wide, sides slightly incurved, apical margin slightly convex.

Antenna 2, 2nd joint of flagellum 3 times 1st.

Uropod, peduncle subquadrangular, filling space between telson and 5th pleon segment, outer ramus reaching nearly to apex of peduncle, inner ramus long, extending to apex of telson.

9 × 4 mm. Grey-brown, lighter at sides, uropods red.

Locality.—Transvaal : Makapan Caves (Dollfus).

This species is very near to *nigrinus*, differing in the more rounded apex of the telson and the slightly wider (less narrowed) apex of peduncle of uropod.

Bethalus macrodens n. sp.

(Fig. 44, a-c.)

Surface minutely granulate. Rugae distinct, forming on each segment a transverse series of rounded but rather conspicuous tubercles, continuous across the middle line. Epistome not strongly raised.

Epimeral margin of segment 1 strongly reflexed so that under surface is strongly tumid, the actual margin thin, internal tooth large, its outer margin traceable almost to antero-lateral corner of segment. Internal tooth on segment 2 strong but slender, in the middle of the epimeron, not adjacent to anterior margin.

Pronotum on segment 2 one-eighth, becoming on posterior segments one-sixth.

Telson very slightly broader than long, sides incurved, apical

margin almost straight, dorsally with 2 rather conical tubercles near base, and a more longitudinally elongated median tubercle about at level of insertion of outer rami of uropod.

Antenna 2, 2nd joint of flagellum 3 times 1st.

Uropod, peduncle narrowing distally, but apex subquadrate, outer ramus moderate, extending half-way to apex of peduncle, inner ramus short, twice as long as broad, extending one-quarter distance to apex of telson.

10 × 5 mm. Slaty-grey, mottled with paler.

Locality.—Cape Province: Groot Vaders Bosch, Langeberg Mts., near Heidelberg (K. H. B.).

In general appearance (thin and strongly reflexed epimeral margin of 1st segment) and structure of head this species is a *Bethalus*, but it has an unusually narrow pronotum, especially on segment 2. A further transition to *Diploexochus* is shown in the indication of a groove parallel to, but some little distance removed from, the margin of 1st segment. It resembles somewhat *limbatus* as regards the telson, but the teeth on segments 1 and 2 are quite distinctive.

Bethalus barbertoni n. sp.

(Fig. 45.)

Surface minutely granulate. Rugae obsolete. Epistome not strongly raised.

Internal tooth on segment 1 rather small, flanked on outside by a rounded thickening, without, however, any groove between it and the

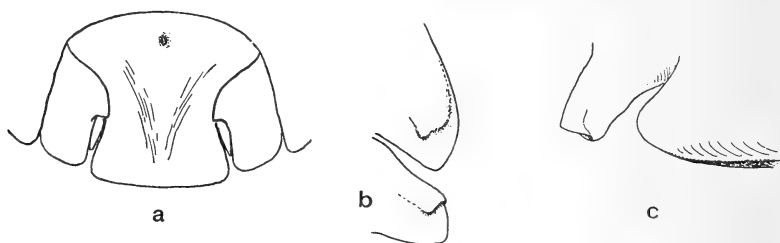


FIG. 45.—*Bethalus barbertoni* n. sp. a, Telson and uropods; b, ventral view of epimera 1 and 2; c, external lateral view of epimera 1 and 2.

margin; that on segment 2 rather well developed, forming a flap which extends to anterior margin, and is visible from outside in lateral view. Epimera of segments 5–7 with slight transverse thickenings below.

Telson a little broader than long, apical margin slightly convex, sides incurved, dorsally smooth, with a small shallow median pit near base (obscure in juveniles); ventrally with median groove at base.

Antenna 2 rather stout, flagellum distinctly more slender than peduncle, 2nd joint 3 times 1st.

Uropod, peduncle apically subquadrate, outer ramus not reaching apex of peduncle, outer inner ramus half-length of peduncle, extending half-way to apex of telson.

13 × 6 mm. Slaty-grey, with pale dorso-lateral flecks, uropods pale.

Localities.—Cape Province: Port St. Johns (S.A. Mus.).

Transvaal: Barberton (S.A. Mus.); Komatipoort (R. W. E. T.); Kaapmuiden (R. W. E. T.); Sabie Game Reserve (E. L. G.).

Portuguese East Africa: Wanetsi River, tributary of Komati River (S.A. Mus.); Inhambane (K. H. B.); Maxixe (R. F. L.).

In the shapes of the internal teeth on segments 1 and 2, this species forms somewhat of a transition to *Diplexochus*, but the mandible and pronotum show it to be better placed in *Bethalus*.

The Port St. Johns specimens have a slightly shorter telson.

Bethalus mucidus (B-L.).

(Fig. 46.)

1885. *Armadillo mucidus*. Budde-Lund, Crust. Isop. Terr., p. 32.

1904. „ „ *Id.*, Rev. Crust. Isop. Terr., p. 131.

1904. „ *latifrons*. *Id.*, *ibid.*, p. 132, pl. x, figs. 39–44.

Surface minutely granulate (appearance really caused by minute transverse impressions). Rugae distinct laterally but scarcely so medio-dorsally. Epistome considerably raised.

Peraeon segment 1 with postero-lateral corner subtruncate, emarginate; internal tooth prominent, obtuse, externally connected with the lateral margin by a slight thickening; internal tooth on segment 2 obtuse.

Epimera of segments 5 and 6 ventrally thickened. On epimera 2–7 there is a transverse or slightly oblique ridge on dorsal surface.

On epimera 2–7 there is also a faint submarginal ridge (*i.e.* parallel with body axis) on the lower surface.

Telson a little broader than long, apical margin almost straight, sides slightly incurved, dorsally somewhat convex basally, often with

an obscure median impression, followed by an obscure medio-longitudinal ridge; ventrally with median groove.

Antenna 2, 2nd joint of flagellum 2 to nearly 3 times 1st.

Uropod, peduncle narrowing distally, outer ramus reaching nearly to apex of peduncle, inner ramus extending $\frac{2}{3}$ — $\frac{3}{4}$ distance to apex of telson.

Up to 20×9 mm. ($\sigma\sigma$ smaller than ♀♀). Slaty-grey or brownish, sometimes uniform with the lateral rugae pale, but usually more or less strongly mottled, antennae more or less suffused, eyes black.

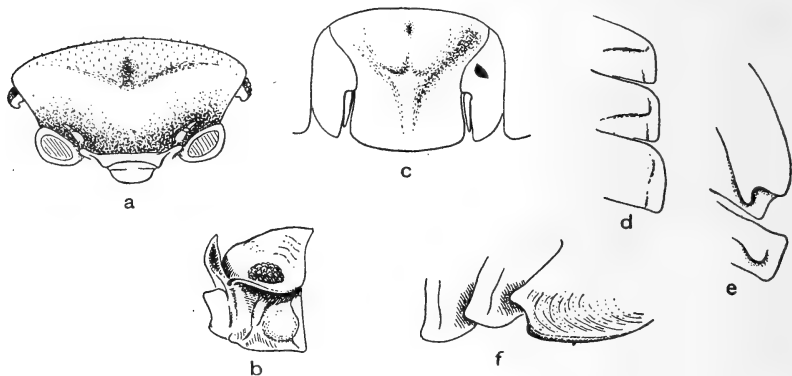


FIG. 46.—*Bethalus mucidus* (B.-L.). *a*, *b*, Frontal and lateral views of head; *c*, telson; *d*, ventral view of epimera 5-7; *e*, ventral view of epimera 1 and 2; *f*, external lateral view of epimera 1 and 2.

Localities.—Cape of Good Hope (Budde-Lund, coll. Drege, see p. 179).

Natal: Port Natal (= Durban) (Budde-Lund); Amanzimtoti (W. F. P.); Umgeni Valley (S.A. Mus.); Durban and Inchanga (K. H. B.).

Portuguese East Africa: Lorenzo Marques (K. H. B.).

As regards *mucidus* and *latifrons*, the former is not represented in the Budde-Lund collection in the British Museum, but the two descriptions are so extraordinarily alike that one cannot doubt the synonymy. Both *mucidus* and *latifrons* have the high raised epistome, and the "duplicatura" on the under surface of the 5th-7th epimera.

In some specimens from the Umgeni Valley the basal median impression on the telson is better marked than usual; consequently the raised portion on either side shows up better, and in some specimens the telson might almost be described as basally bituberculate, and bears a close resemblance to that of *warreni*.

Bethalus warreni (Cllege.).

(Fig. 47.)

1917. *Cubaris warreni*. Collinge, Ann. Nat. Mus., iii, p. 569,
pl. xl, figs. 1-10.

1920. „ „ *Id., ibid.*, iv, pl. xxvii, fig. 1.

Surface minutely granulate. Rugae distinct. Epistome considerably raised.

Peraeon segment 1 with postero-lateral corner subtruncate, internal tooth acute; internal tooth on segment 2 subacute, extending to

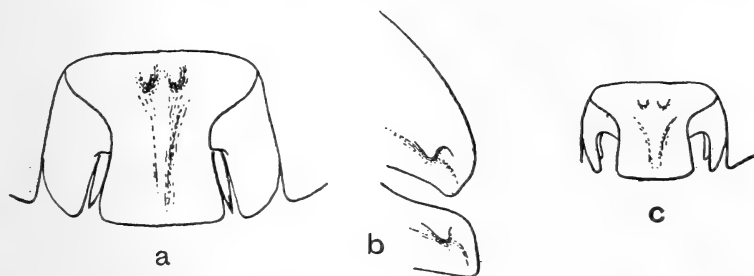


FIG. 47.—*Bethalus warreni* (Cllege.). *a*, Telson and uropods of Howick specimen; *b*, ventral view of epimera 1 and 2 of same; *c*, telson and uropods after Collinge.

anterior margin. Epimera of segments 5-7 with transverse thickening below.

Telson broader than long, apical margin nearly straight, sides scarcely incurved, dorsally with 2 low tubercles basally, followed by a slight medio-longitudinal ridge; ventrally with median groove.

Antenna 2 very slender, especially the flagellum, 2nd joint $2\frac{1}{2}$ times 1st.

Uropod, peduncle subtriangular, narrowing (in the typical form) to a pointed apex, and leaving a marked gap between telson and 5th pleon segment, but sometimes subacute, outer ramus extending nearly to apex of peduncle, inner ramus long, extending nearly to apex of telson.

Up to 12×5.5 mm. In alcohol, greenish brown, with lighter mottling.

Localities.—Natal: Krantz kop (Collinge); Howick (W. F. P.).

Neither the mandibles nor the pronotum were mentioned in the original description. The species is assigned to *Bethalus* on account of the internal teeth on segments 1 and 2. The two specimens from

Howick confirm this. They can scarcely be regarded otherwise than as a variety of *warreni*. The only feature in which they do not agree with Collinge's description is the uropod; and it should be noted that the shape of the uropod in the whole figure of the animal on pl. xxvii (1920) is quite different from that in figs. 9 and 10 accompanying the original description.

Bethalus secutor (Jackson).

(Fig. 48.)

1924. *Cubaris secutor*. Jackson, J. Linn. Soc. Lond., xxxvi, p. 25, pls. i, ii.

Surface strongly setose. Rugae distinct. Epistome strongly raised.

Peraeon segments with the hind margin produced backwards in a median point, feeble on segment 1 but becoming progressively larger,

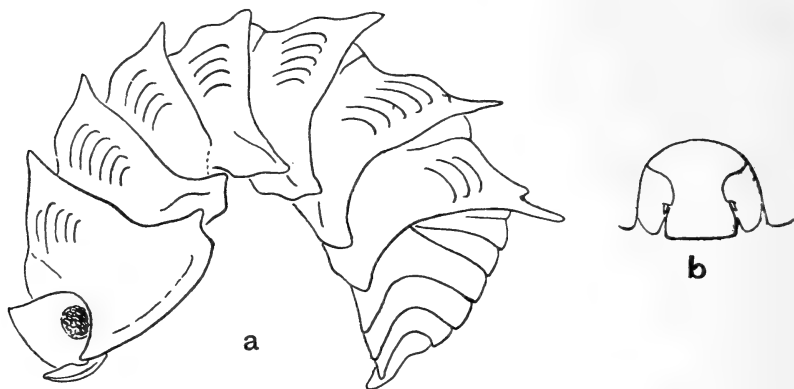


FIG. 48.—*Bethalus secutor* (Jackson). *a*, Lateral view of whole animal (epimeron of segment 3 defective) after Jackson, surface setae omitted; *b*, telson and uropods after Jackson.

that on segment 7 flanked on either side by a sharp tubercle. Internal teeth on segments 1 and 2 well marked.

Telson about as broad as long, apical margin nearly straight, sides incurved, dorsally bituberculate at base.

Uropod, peduncle narrowing to a narrowly rounded apex, but not leaving any gap between telson and 5th pleon segment, outer ramus moderately long, extending about to apex of peduncle, inner ramus moderately long.

8.5 × 5 mm. In alcohol, slaty-blue, flecked with grey.

Locality.—Zululand : Lower Umfolosi (Jackson).

This remarkable species should be included in the genus *Bethalus*. The pronotum is broad, and the mandible has a single free penicil. Moreover, it possesses the same features which distinguish *mucidus* and *warreni* from the other species, viz. the strongly raised epistome, the transverse ridge of 2nd-7th epimera, the subtruncate postero-lateral corner of peraeon segment 1, and also (apparently) the transverse ridge on underside of 5th and 6th (but not 7th) epimera.

Bethalus barnardi (Collge.).

1920. *Cubaris barnardi*. Collinge, Ann. Nat. Mus., iv, p. 482, pl. xxxi, figs. 67-76.

In general resembling *secutor*, but much less strongly sculptured. The median projection on the peraeon segments is not developed at all on segments 1-4, only very feebly on 5, and moderately on 6 and 7 (*cf.* Collinge's fig. 67). Internal tooth on segment 1 similar to that of *mucidus*.

Epimera of segments 5-7 with transverse ridge on lower surface, the anterior and inner portion of the epimera being thickened (*cf.* *mucidus*). There is a slight longitudinal (*i.e.* parallel with body axis) ridge across the pleurae of pleon segment 3, continuing the line of the submarginal edge of the thickenings on epimera 5-7, and sometimes a much fainter ridge on pleon segment 4 also.

Pronotum on segment 2 one-quarter, on posterior segments almost or quite one-third.

Antenna 2 slender, 2nd and 4th joints subequal, 2nd flagellar joint $2\frac{1}{2}$ -3 times 1st.

Uropod, outer ramus longer than in *secutor*, extending almost to apex of peduncle, and equal to $\frac{3}{4}$ length of inner ramus.

Up to 16×7.5 mm. (20.5 mm., Collinge). In alcohol, brownish or greyish, mottled, eyes black.

Localities.—Natal: Sarnia and Winkle Spruit (Collinge); M'fongosi, Zululand (Collinge; also S.A. Mus.); Pietermaritzburg and Krantz-kop (Natal Mus.).

I have examined a large number of specimens collected by Mr. W. E. Jones, in size from 4 mm. upwards. The sculpturing does not vary, so that this form and *secutor* may be considered separate species. The differences in sculpture and outer ramus of uropod are certainly great enough to justify specific rank. The difference in length of pronotum is perhaps not really so great. Jackson's fig. 1, on pl. i,

has the visible portion of the pronotum on segment 7 slightly greater than $\frac{1}{4}$, i.e. not including the median projection. But whether *barnardi* should be separated from *mucidus* is very doubtful; the question can only be cleared up by detailed collecting and observation, whether forms with a short process on hind margin of 7th segment occur in the same locality together with forms without any trace of a process.

Gen. AKERMANIA Cllge.

1919. *Akermania*. Collinge, Ann. Nat. Mus., iv, p. 230.

Head concrete, antennary tubercles not distinct, epistome adnate to head dorsally, lateral marginal line of head continuous with margin of epistome.

Epimera, especially 1 and 2, spread out more or less horizontally, margin of 1st thin, internal teeth on 1st and 2nd well developed.

Pronotum very broad, $\frac{1}{3}$ – $\frac{2}{5}$ length of segment.

Antenna 2 with 2-jointed flagellum. Mandible with a single free penicil. Inner lobe of maxilla 1 with 2 slender, subequal plumose setae, outer apex quadrate.

Peraeopod 1 with feeble groove on anterior surface of 5th joint.

Uropod, peduncle oblong, outer ramus minute, cylindrical.

Genotype: *spinosa* Cllge.

But for the broad pronotum, this form could be included in *Polyacanthus*; in fact it bears a very close external resemblance to *P. aculeatus*. The broad pronotum, however, points to *Bethalus*, and in spite of Collinge's opinion that *Akermania* is widely separated from *Cubaris* or any of the allied genera, it seems to me to be essentially related to *Bethalus*, though the lateral marginal line of head is continued on to the epistome as in *Cubaris*.

The 1st antennae are present.

Nicholls and Barnes (1926, J. Roy. Soc. West Austr., xii, pp. 149, 153, 154) draw attention to the strong likeness between their *Cubaris wilsmorei* and *Akermania spinosa*. In my opinion *wilsmorei* should be transferred to *Akermania*, provided it has a broad pronotum, which feature is not mentioned by the authors.

Akermania spinosa Cllge.

(Fig. 49.)

1919. *Akermania spinosa* Collinge, loc. cit., p. 230, pl. xiv, figs. 1–12 (fig. 1 shows 8 peraeon segments and 4 expanded pleon segments).

Surface minutely setulose, with numerous short spinous processes, whose bases are connected by low ridges.

Head with 3 transverse rows of spines, the anterior row with 4, the middle one with 6, the posterior one with 3 spines. Epistome distinctly, though not strongly, raised above dorsal surface of head; dorso-lateral angles rounded and partly covering eyes in frontal view (contrast Collinge's fig. 2), in front convex above, concave below,

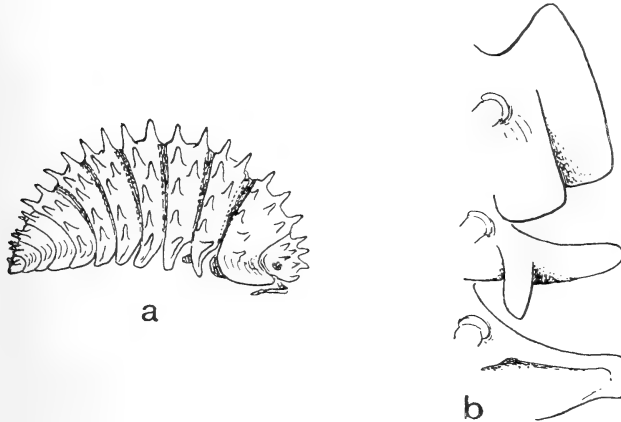


FIG. 49.—*Akermania spinosa* Clge. *a*, Lateral view of whole animal; *b*, ventral view of epimera 1-3.

the dorsal margin medianly slightly recurved, and in some positions appearing slightly emarginate.

Peraeon segment 1 with 3 transverse rows of spines, respectively with 4, 4, 10 spines. The two outside ones of the posterior row should perhaps be reckoned to the middle row, when the formula would read 4, 8, 6. Epimera nearly horizontal, internal tooth or lamina strong, subquadrate.

Peraeon segments 2-6 each with 2 transverse rows of spines, respectively with 4 and 10 spines. Epimera becoming less horizontal posteriorly, 2 and 3 narrowed, 4-6 less so, internal tooth on 2 prominent, acute in ventral view, but rounded in lateral view (visible externally), 3-6 each with a transverse ridge below, well marked on 3, but fainter on the other epimera.

Peraeon segment 7 with 2 transverse rows of spines, respectively with 8 and 4 spines.

Pleon segments 3-5 with the pleurae slightly spread, but not quite horizontal, each with 2 submedian spines.

Telson much broader than long, apical margin straight, shorter than length, dorsally with 2 spines.

Antenna 2, 2nd and 4th joints subequal, 2nd joint of flagellum 3 times 1st.

Uropod, peduncle broad proportionately to length, apex subquadrate, completely filling space between telson and 5th pleon segment, outer ramus minute, inner ramus extending half-way to apex of telson.

4 × 2 mm. Pale straw-colour, segments 1 and 7 rather irregularly suffused with brown, chiefly laterally, eyes black.

Localities.—Natal: Umhlali and Winkle Spruit (Collinge); Stella Bush, Durban (K. H. B.).

There may be some variation in the number and arrangement of the spines. The above description is taken from my Durban ♀. Collinge's fig. 2 shows 3 series on the head, with respectively 3, 6, 3 spines; his fig. 1 shows 2 rows with 4 and 5 spines respectively. He states that there are 2 rows on the segments of the mesosome (peraeon); his fig. 1 shows only 1 row of 6 spines on segment 1, and 2 rows of 6 each (usually) on segments 2–7; fig. 7, a transverse view of segment 1, shows 2 rows of 4 and 10 spines. These differences are probably due to the draughtsman, who also seems at least partly responsible for the manifest inaccuracies of fig. 1.

The 1st antennae are quite distinct in my specimen. The uropods fill the space between telson and 5th pleon segment. Nevertheless there cannot be the slightest doubt that the Durban specimen, from a locality roughly midway between the two original localities, is conspecific.

Gen. POLYACANTHUS B-L.

1904. *Armadillo* (part). Budde-Lund, Rev. Crust. Isop. Terr., pp. 97, 116 (Section iv).

1909. *Polyacanthus*. *Id.*, in Schultze, Reise, ii, p. 54 (subgen. of *Armadillo*).

Head concrete, antennary tubercles not distinct, epistome without median raised shield, lateral marginal line of head continuous with epistome.

Hind margin of peraeon segment 1 sinuate. Epimeron of segment 1 large, thin; internal teeth on segments 1 and 2 small.

Pronotum narrow.

Antenna 2, 2nd and 4th joints subequal, flagellum 2-jointed. Mandible with a single free penicil. Maxilla 1 with 2 unequal rather

short plumose setae on inner lobe, the outer apex of which is rounded.

Uropod, peduncle oblong, outer ramus cylindrical, minute.

Genotype: *aculeatus* (B.-L.).

Key to the species.

1. Head and peraeon spinose *aculeatus*.
2. Head and peraeon rugulose and tuberculate *transvaalensis*.

Polyacanthus aculeatus (B.-L.).

1885. *Armadillo aculeatus*. Budde-Lund, Crust. Isop. Terr., p. 289.

1904. *Polyacanthus* „ *Id.*, Rev. Crust. Isop. Terr., p. 117,
pl. x, figs. 10–13.

Head with 4 spines in a transverse row. Peraeon segments each with 6 spines in a transverse row, the 2 median ones smaller than the others. Pleon segments 3–5 each with 2 small spines. Telson as long as broad, subquadragular, sides incurved.

7 × 4 mm.

Locality.—Chinchoxo, Portuguese Congo (Budde-Lund).

This is not a South African species, but is included for the sake of completeness and comparison with the following species.

Polyacanthus transvaalensis n. sp.

(Fig. 50.)

Strongly convex, 1st epimeron and the pleurae spread out more or less horizontally, the other epimera less so. Surface strongly squamulose with smaller squamulae interspersed among the larger ones, especially on hind margins of segments.

Head rugulose. Eyes well developed. Epistome strongly raised above dorsal surface of head, in front flat, dorsal margin gently convex, dorso-lateral angles quadrate.

Peraeon segment 1 with a V-shaped median boss anteriorly, flanked by 2 smaller rounded bosses on either side, about 12 elongate rugae in a transverse series, and a series of small rounded tubercles on the hind margin alternating with the rugae.

Peraeon segments 2–7 distinctly divided into a smooth anterior portion and a raised posterior portion, the latter bearing on each segment a transverse series of about 14 rugae, followed by smaller tubercles alternating with them.

Pronotum of segment 2 one-twelfth, of posterior segments about one-tenth dorsal length of segment.

Epimeron of segment 1 large, thin, splayed outwards but not reflexed; internal tooth on both segments 1 and 2 small, rounded.

Segments 5-7 with faint longitudinal (*i.e.* parallel to body axis) ridge about midway between insertion of peraeopods and lateral margins of epimera.

Pleon segments 3-5 each with 4 rounded bosses, the 2 inner ones larger than the outer ones, especially on segment 5.

Telson longer than broad, anterior and posterior widths subequal,

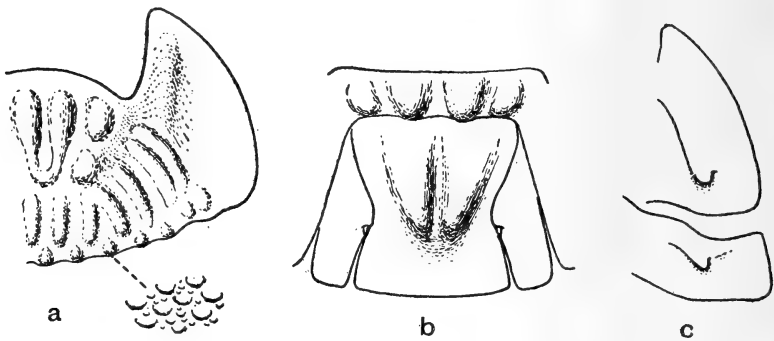


FIG. 50.—*Polyacanthus transvaalensis* n. sp. a, Dorsal view of peraeon segment 1; b, 5th pleon segment, telson, and uropods; c, ventral view of epimera 1 and 2.

sides incurved, apical margin nearly straight, dorsally with a prominent rounded boss proximally, divided by a medio-longitudinal groove.

Antenna 2 short and stout, 2nd joint slightly longer than 4th, flagellum scarcely as long as 4th joint, much narrower than 5th, its 2nd joint 3 times 1st.

Peraeopod 1 with very feeble groove on anterior surface of 5th joint.

Uropod, peduncle considerably longer than wide, distally narrowed to a subquadrate apex, which extends slightly beyond margin of telson and pleurae of 5th pleon segment, outer ramus minute, inner ramus short, twice as long as broad.

9 × 4 mm. Slaty-grey, eyes black, antennae and legs pale.

Locality.—Transvaal: Zoutlansberg (R. F. L.).

This species is referable to Budde-Lund's Section iv = *Polyacanthus*. The name proves to have been unfortunately chosen, as this species is not spinose like *aculeatus*. It forms an interesting extension of the genus.

Gen. DIPLOEXOCHUS Brdt.

1833. *Diploexochus*. Brandt, Conspect. Onisc.
 1904. *Armadillo* (part). Budde-Lund, Rev. Crust. Isop. Terr.,
 pp. 97, 100 (Section ii).
 1909. *Diploexochus*. *Id.*, in Schultze, Reise, ii, p. 54 (subgen. of
Armadillo).
 1910. „ *Id.*, Voeltzkow, Sjöstedts Kilimandjaro-
 Meru Exp., iii, p. 11.

Head concrete, antennary tubercles not distinct, epistome without median raised shield, adnate to dorsal surface of head, lateral marginal line of head continued on to epistome.

Hind margin of peraeon segment 1 more or less sinuate. Epimeron of segment 1 with margin thin or costate, more or less completely grooved, at least near hind corner, internal fold and tooth well developed; internal fold or tooth on segment 2 usually well developed.

Pronotum narrow or very narrow, seldom exceeding one-seventh of length of segment, usually much less.

Antenna 2 with 2-jointed flagellum. Mandible with a single free penicil. Maxilla 1 with 2 subequal slender plumose setae on inner lobe, the outer apex of which is rounded.

Peraeopod 1 with groove on anterior surface of 5th joint.

Uropod, peduncle oblong or subquadrangular, outer and inner rami moderate or more usually short, often very short, the outer ramus being minute or obsolescent, when present cylindrical.

Genotype: in 1904 Budde-Lund gave *clausus* B-L. (S. America) as genotype of his Section ii, but in 1909 substituted *echinatus* Brdt. (S. America).

According to Budde-Lund (1904) the genus extends over the north-eastern and north parts of South America (one species in Chile), central and southern parts of North America, West Indies, Canary Islands, Cape Verde Islands, and Africa (one species in South Spain). Some of the species, however, may perhaps have been wrongly assigned.

This is the most numerous, and the most difficult genus of the Cubarids. As will be seen from the following pages, a moderate amount of collecting has produced a large increase in the number of known species; and obviously many more still await discovery.

As a generic character the width of the pronotum, especially if taken in conjunction with other characters, appears to be sound, though subject to considerable range. At one end of the scale it is very narrow, as in Budde-Lund's Section i (*Pentheus officinalis*); at

the other end it is very broad as in *Bethalus*. As a specific character there need be no hesitation in using it, in spite of the gradation. But I express no opinion as to whether it can be regarded as an indication of affinity. The species are here arranged according to the width of the pronotum solely for the sake of convenience.

Neither the distribution nor the habitats of the species disclose any correlation between the width of the pronotum and the environment. All the species with very narrow pronotum are subtropical (synopsis 1a), but there are also subtropical species with only a moderately narrow pronotum (*rhodesiensis*, *makuae*, *tugelae*; excluding *aenigma* and *cingulatus* as outstanding exceptions in the whole genus). Most of the species have a pronotal width of $\frac{1}{12}$ – $\frac{1}{10}$ (synopsis 1c) and they are mostly congregated in the southerly and south-westerly areas of South Africa, the explanation being merely that more collecting has been done in these areas. There are species living in the plains, as well as species living on the mountain-tops. Myrmecophily does not afford an explanation. The faculty of "congloabation" seems to be no better developed in those species with a narrow pronotum than in those with a wide pronotum; though one would like to think that some correlation might be demonstrable by a close study of the habits and habitats of the animals.

The *tabularis* group, comprising *tabularis*, *ecaudatus*, *albanyensis*, and *hypselos*, is interesting as showing the same method of interlocking of peraeon segments 1 and 2 as is found in *Microcercus*. *D. tuberosus* (Budde-Lund, 1904, pl. x, fig. 1) from the West Indies also exhibits the same feature.

Instead of a dichotomous key, I have followed Budde-Lund in giving a synopsis of the South African species. By elimination a specimen can be run down to a group of species, and can then be identified by reference to the descriptions and figures.

- | | | |
|------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1a. Pronotum very narrow, linear, $\frac{1}{20}$ – $\frac{1}{15}$ of dorsal length of segment (segment 2 measured) | { | <i>formicarum</i> , <i>ovampoensis</i> , <i>kaokoensis</i> , <i>nanus</i> , <i>obliquidens</i> , <i>thomsoni</i> , <i>damarensis</i> , <i>salisburyensis</i> . |
| 1b. Pronotum narrow, $\frac{1}{15}$ – $\frac{1}{12}$ | | <i>saldanhae</i> , <i>steenbrasi</i> . |
| 1c. Pronotum moderately narrow, $\frac{1}{12}$ – $\frac{1}{10}$ | { | <i>nigricans</i> , <i>pachytos</i> , <i>dollfusi</i> , <i>mixtus</i> , <i>kogmani</i> , <i>albescens</i> , <i>rufescens</i> , <i>coloratus</i> , <i>flavescens</i> , <i>festivus</i> , <i>montagui</i> , <i>oraniensis</i> , <i>herscheli</i> , <i>orphanus</i> , <i>alticola</i> , <i>rhodesiensis</i> , <i>pauperculus</i> , <i>polythete</i> , <i>meiringi</i> , <i>alberti</i> , <i>tugelae</i> , <i>pusillus</i> , <i>tabularis</i> , <i>ecaudatus</i> , <i>albanyensis</i> , <i>hypselos</i> . |

- 1d. Pronotum moderate, $\frac{1}{8}-\frac{1}{4}$ { *pubescens*, *conisaleus*, *makuae*,
limenites, *hypsinephes*, *zwart-*
bergensis, *nebulosus*, *furcatus*,
castor, *celsicauda*.
- 1e. Pronotum rather broad, $\frac{1}{6}-\frac{1}{3}$ { *disjunctus*, *longipes*, *quadrimacu-*
latus, *gordoniensis*, *pilula*.
- 1f. Pronotum broad, $\frac{1}{4}-\frac{1}{3}$ { *aenigma*, *cingulatus*.
Unknown: *orbicularis*, *liliputanus*, *natalensis*, *truncatus*.
- 2a. Epistome rising considerably above
dorsal surface of head { *formicarum*, *makuae*, *orbicularis*.
- 2b. Epistome not strongly raised all other species.
- 2c. Epistome feebly demarcated from head
dorsally { *kaokoensis*, *thomsoni*, *damarensis*,
saldanhae, *steenbrasi*, *pilula*.
ovampoensis, *kaokoensis*, *nanus*,
salisburyensis, *saldanhae*, *steen-*
brasi, *mixtus*, *kogmani*, *meiringi*,
alberti, *tugelae*, *pusillus*, *tabularis*,
makuae, *aenigma*, *liliputanus*,
natalensis.
- 3a. Peraeon segment 1 grooved along whole
length of epimeral margin all other species.
- 3b. Peraeon segment 1 partially grooved all other species.
- 3c. Peraeon segment 1 without marginal
groove { *formicarum*, *oraniensis*, *herscheli*,
albanyensis, *hypselos*, *pubescens*,
conisaleus, *longipes*, *quadrimacu-*
latus, *cingulatus*.
ovampoensis, *nanus*, *obliquidens*,
thomsoni, *salisburyensis*, *saldan-*
hae, *steenbrasi*, *nigricans*, *kogmani*,
herscheli, *alberti*, *tugelae*, *pusillus*,
pubescens, *conisaleus*, *zwartberg-*
ensis, *nebulosus*, *gordoniensis*,
pilula, *orbicularis*, *liliputanus*.
- 4a. Peraeon segment 1 with hind corner
equally or subequally cleft (i.e. the
inner lamina or tooth extends back-
wards to, or almost to, the level of
hind margin of segment) all other species.
- 4b. Peraeon segment 1 distinctly unequally
cleft all other species.
- 5a. Outer ramus of uropod minute or
obsolescent { all of 1a except *thomsoni*; 1b;
dollfusi, *albescens*, *alticola*, *rho-*
desiensis, *pauperculus*, *polythele*,
meiringi, *alberti*, *tugelae*, *pusillus*,
tabularis, *ecaudatus*, *albanyensis*,
hypselos, *pubescens*, *conisaleus*,
makuae, *longipes*, *quadrimacu-*
latus, *gordoniensis*, *pilula*, *cingu-*
latus, *orbicularis*.
- 5b. Outer ramus of uropod distinct all other species.
- 6a. Inner ramus of uropod long, extending
beyond half-way to apex of telson (as
visible from below) { *kaokoensis*, *thomsoni*, *steenbrasi*,
herscheli, *tugelae*, *tabularis*, *ecau-*
datus, *albanyensis*, *makuae*, *fur-*
catus, *aenigma*, *cingulatus*, *lili-*
putanus, *natalensis*.

- | | | | |
|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6b. Inner ramus of uropod not exceeding half length of telson, mostly much shorter | } all other species. | { | ovampoensis, kaokoensis, nanus, obliquidens, thomsoni, salisburyensis, saldanhae, mixtus, kogmani, albescens, coloratus, flavescens, festivus, montagui, pubescens, conisaleus, makuae. |
| 7a. A ridge or thickening on lower surface of epimera of segments 5-7 | | | |
| 7b. A similar ridge on pleurae of pleon segments 3-5 in addition to the above ridge on segments 5-7 | } kaokoensis, thomsoni, salisburyensis, pubescens, conisaleus. | { | |
| 7c. A ridge across peduncle (ventral surface) of uropod | | | |
| | | | limenites, hypsinephes. |

Diploexochus formicarum B-L.

(Fig. 51.)

- ? 1895. *Armadillo orbicularis*. Dollfus, Mem. Soc. Zool. Fr., viii, p. 345, fig. 2 (*non* B-L.).
1909. *Diploexochus formicarum*. Budde-Lund in Schultze, Reise, ii, p. 57, pl. v, figs. 44-56.
1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 447.

Rugae distinct, segment 1 with 7 granules on anterior margin, the 2 median ones largest, followed by 2 transverse rows of granules, the posterior ones smaller, segments 2-7 distinctly divided into a smooth anterior portion and a raised posterior portion bearing 2 transverse rows of granules on each segment, the granules of the posterior row smaller than the anterior ones; pleon segments 3-5 each with a transverse row of granules.

Eyes moderate. Epistome considerably raised above surface of head.

Peraeon segment 1, margin thin, slightly reflexed, not grooved, hind corner unequally cleft, internal tooth small; internal tooth on segment 2 small.

Pronotum very narrow, linear.

Telson slightly broader than long, sides slightly incurved, apical margin almost straight, dorsally with 2 submedian rounded ridges or elongate tubercles proximally.

Antenna 2 short and stout, 2nd joint longer than 4th, flagellum equal to 4th joint, its 2nd joint not quite 3 times 1st.

Uropod, peduncle considerably longer than wide, narrowing to the

subquadrate apex, outer ramus minute, inner ramus short, twice as long as broad.

3.5 × 1.6 mm. In alcohol, greyish-white, unicolorous.

Localities.—Bechuanaland: Vryburg (Dollfus); Kooa, Kalahari (Budde-Lund).

Although it is clear that the *orbicularis* of Dollfus is not the true *orbicularis* of B-L., I am not quite sure that it is the same as *formicarum*. Dollfus says the 1st peraeon segment is grooved throughout its length, and that the epistome is not raised above the level of the head.

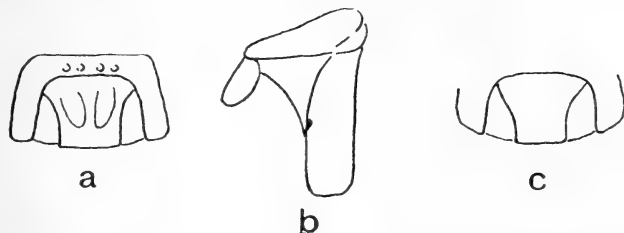


FIG. 51.—*Diploexochus formicarum* B-L. a, 5th pleon segment, telson and uropods after Budde-Lund; b, dorsal view of uropod after Budde-Lund; c, telson of *orbicularis* Dollf. non B-L., after Dollfus.

But his figure of the telson and uropods resembles Budde-Lund's figures of these parts, except for the absence of the two ridges on the telson.

The (comparative) nearness of the two localities is in favour of specific identity.

Diploexochus salisburyensis n. sp.

(Fig. 52.)

Surface minutely granulate (shagreened). Rugae obsolete or very faintly indicated. Epistome not strongly raised.

Peraeon segment 1, epimeral margin thick, reflexed, grooved throughout its length, hind corner equally cleft, internal tooth rounded; internal tooth on segment 2 well developed.

Pronotum very narrow, almost linear, $\frac{1}{20}$ of dorsal length of segment.

Epimera of segments 5–7 with a transverse (*i.e.* to body axis) ridge on lower surface, petering out slightly before reaching margin.

Pleurae of pleon segments 3–5 with a low ridge or thickening on lower surface near hind margin.

Telson a little broader than long, sides incurved, apical margin nearly straight, dorsally raised with a shallow more or less conspicuous oval or lozenge-shaped impression.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint 4 times the 1st.

Uropod, peduncle longer than broad, apex subquadrate, outer ramus very small but distinct, inner ramus short, twice as long as broad, extending scarcely half-way to apex of telson.

Up to 9×3.5 mm. In alcohol, greyish, eyes darker.

Locality.—Rhodesia : Salisbury (R. W. E. T.).

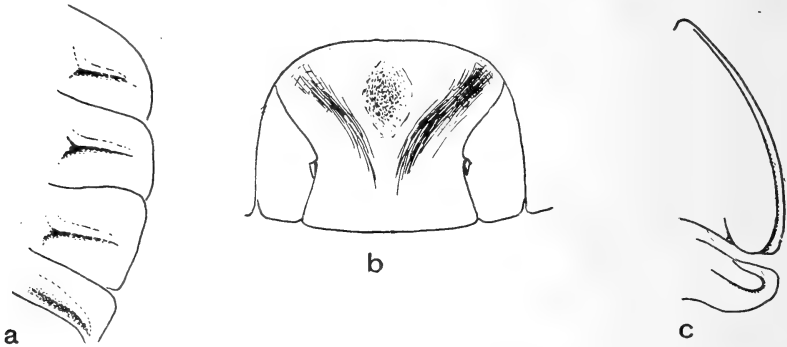


FIG. 52.—*Diploexochus salisburyensis* n. sp. *a*, Ventral view of epimera 5-7 and pleura of pleon segment 3; *b*, telson and uropods; *c*, ventral view of epimera 1 and 2.

Compared with *obliquidens* this species has a narrower epimeron on peraeon segment 2, with a less oblique tooth, a slightly more convex telson with a slightly stronger impression. The margin of peraeon segment 1, moreover, is grooved throughout.

Diploexochus ovampoensis (Brnrd.).

(Fig. 53, *d*.)

1924. *Cubaris ovampoensis* (part). Barnard, Ann. S. Afr. Mus., xx, p. 232, fig. 1.

Surface minutely squamulose-granulose. Rugae feebly developed. Epistome not strongly raised.

Peraeon segment 1 with a low rounded median boss anteriorly, obscurely divided by a medio-longitudinal faintly impressed line; epimeral margin reflexed, grooved throughout its length, hind corner equally cleft, internal tooth rounded; internal tooth on segment 2 strong, narrow, curving obliquely posteriorly.

Pronotum very narrow.

Epimera of segments 5-7 with transverse ridge on lower surface.

Telson broader than long, sides slightly incurved, apical margin nearly straight, dorsally convex and tumid proximally, with a faint medio-longitudinal impressed line.

Antenna 2, 2nd joint a trifle longer than 4th, 2nd flagellar joint $2\frac{1}{2}$ to nearly 3 times 1st.

Uropod, peduncle about as broad as long, or very slightly longer than broad, apex subquadrate, outer ramus minute, inner ramus short, twice as long as broad.

Up to 6×2.5 mm. Slaty-grey, with lighter reticulation on head and peraeon, lateral margins usually paler, eyes black.

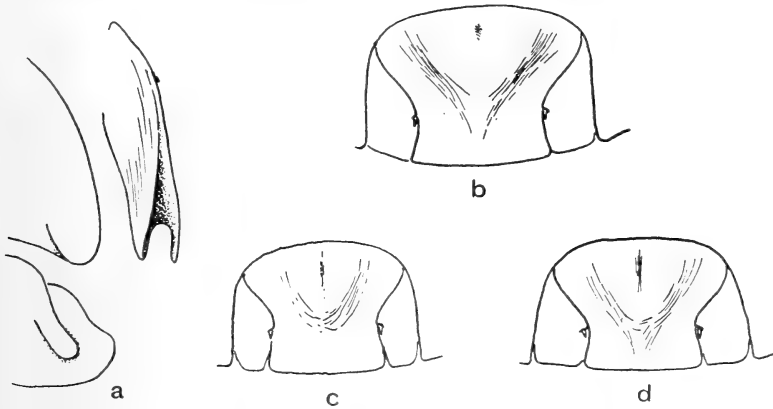


FIG. 53.—*Diploexochus obliquidens* n. sp. a, Ventral view of epimera 1 and 2, with marginal view of epimeron 1; b, telson and uropods. *D. nanus* B-L.: c, telson and uropods, after MSS. drawing by Budde-Lund in British Museum. *D. ovampoensis* (Brnrd.): d, telson and uropods.

Localities.—Ovamboland: Namakunde and Ongandjera (Barnard).

This species has a slightly stouter internal tooth on segment 2, and a more tumid telson than *obliquidens*, in both of which characters it is very close to *nanus*; it differs, however, from both these species in having the whole margin of segment 1 grooved. I am unable to determine whether this species is the same as *bituberculatus* B-L., 1910, from Kilimanjaro, which has the whole margin of segment 1 grooved, and the MSS. figure of which shows a telson similar to that of *ovampoensis*. Only a comparison of actual specimens can decide.

Re-examination of the original specimens shows that the specimens from Erikson's Drift, formerly included under this species, are really referable to the form here identified as *nanus*.

Diploexochus obliquidens n. sp.

(Fig. 53, a, b.)

Surface minutely granulate. Rugae obsolete. Epistome not strongly raised.

Peraeon segment 1 with margin thick, reflexed, grooved in posterior half, but the groove faintly traceable for about $\frac{2}{3}$ length, hind corner equally cleft, internal tooth rounded. Internal tooth on segment 2 strong, but narrow, curving obliquely posteriorly.

Pronotum very narrow, linear, $\frac{1}{10}$ of dorsal length of segment.

Epimera of segments 5-7 with transverse ridge on lower surface.

Telson a little broader than long, sides gently incurved, apical margin nearly straight, dorsal surface slightly raised with a small very faint median impression.

Antenna 2, 2nd joint a trifle longer than 4th, 2nd flagellar joint 2-2 $\frac{1}{2}$ times 1st.

Uropod, peduncle a little longer than broad, apex subquadrate, outer ramus very small but distinct, inner ramus short, twice as long as broad.

Up to 11 × 5 mm. Slaty-grey, lateral margins pale, eyes black.

Localities.—Transvaal: Messina (R. W. E. T.); Sabie Game Reserve (E. L. G.); Zoutpansberg (R. F. L.).

This species is very close to *nanus* B-L. from the Mt. Meru district in Tanganyika; it is distinguished by the obsolete rugae, the slightly broader 2nd segment, the narrower internal tooth on segment 2, and the less convex telson; the latter difference is deduced from Budde-Lund's description "valde tumido" and his MSS. figure of the telson.

Diploexochus nanus B-L.

(Fig. 53, c.)

1910. *Diploexochus nanus*. Budde-Lund, Sjöstedt, Kilimandjaro-Meru Exp., iii, p. 12, pl. ii, figs. 9-15.
 1924. „ „ Panning, Beitr. Kennt. Land. Süßwasserf. S.W. Afr., ii, p. 178.
 1924. *Cubaris ovampoensis* (part). Barnard, Ann. S. Afr. Mus., xx, p. 232.

This form agrees with *ovampoensis* except that the groove on segment 1 extends only half-way or at most two-thirds along the margin, and the peduncle of uropod is apically narrower.

Up to 7 × 3 mm. Colour like that of *ovampoensis*.

Localities.—Ovamboland : Kunene River, near Erikson's Drift (Barnard).

Kaokoveld : Kaoko Otavi, Otjitundua, and Okorosave (K. H. B.) ; Warmbad (R. F. L. and A. J. H.).

Damaraland : Karibib (Panning).

Great Namaqualand : Seeheim (Panning).

These specimens are evidently the same as those which Panning, with some hesitation, referred to *nanus*. Without comparison of actual specimens, there seems to be considerable justification for Panning's decision, and I follow him here. The main difference which Panning found was caused by a misconception. In measuring the length of the pronotum, Panning included the smooth anterior half of the segment as well as the true articular surface. All the specimens I have seen conform to Budde-Lund's description of the pronotum as very narrow ($\frac{1}{20} - \frac{1}{15}$).

It is curious that Budde-Lund's *bituberculatus* and *nanus* differ from one another in the extent of the groove on segment 1, and the apical width of the peduncle of uropod, exactly as do *ovampoensis* and the South West Africa form assigned to *nanus*. Budde-Lund's MSS. in the British Museum contains unpublished figures of the telson of both species.

Diploexochus thomsoni Pann.

(Fig. 54.)

1924. *Diploexochus thomsoni*. Panning, Beitr. Kennt. Land. Süßwasserf. S.W. Afr., ii, p. 177, fig. 2.

Surface minutely squamulose-granulose. Rugae obsolete. Epistome feebly demarcated from dorsal surface of head, with a small V-shaped median impression dorsally.

Peraeon segment 1 smooth on anterior margin. Epimeral margin thick, reflexed, grooved in posterior third, hind corner subequally cleft, internal tooth rounded, visible externally in lateral view. Internal tooth on segment 2 small, oblique.

Pronotum very narrow, about $\frac{1}{15}$ of dorsal length of segment.

Epimera of segments 5-7 thickened below, forming transverse, or on segment 7 angularly oblique, ridges. Similar oblique ridges on pleurae of pleon segments 3-5.

Telson broader than long, distal portion slightly broader than long, sides gently incurved, distal margin slightly convex, dorsally evenly convex ; ventrally with median groove at base.

Antenna 2, 2nd joints and 4th subequal, 2nd flagellar joint 3-4 times 1st.

Uropod, peduncle slightly longer than broad, apex subquadrate, apical margin $\frac{1}{3}$ length of apical margin of telson, outer ramus small, extending $\frac{1}{4}$ to apex of peduncle, inner ramus rather long, extending $\frac{2}{3}$ to apex of telson, 3-4 times as long as broad.

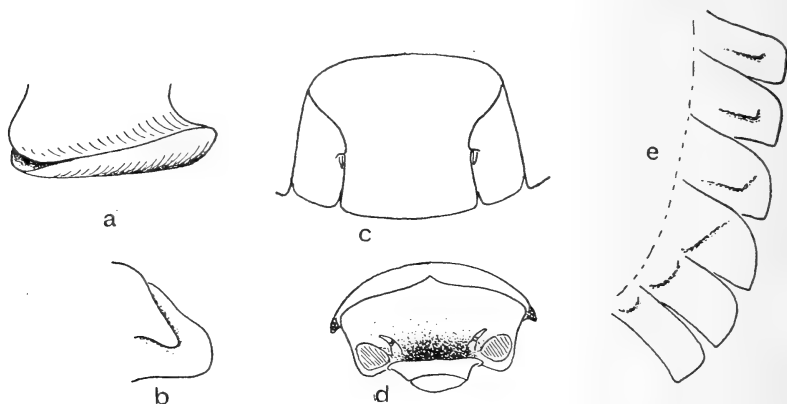


FIG. 54.—*Diploexochus thomseni* Pann. *a*, External lateral view of epimeron 1; *b*, ventral view of epimeron 2; *c*, telson and uropods; *d*, front view of head; *e*, ventral view of epimera 5-7 and pleurae of pleon segments 3-5.

Up to 7×3 mm. Slaty-grey, with paler dorso-lateral flecks, lateral margins often pale, eyes black.

Localities.—Damaraland: Waterberg and Okahandja (Panning); Waterberg (R. W. E. T.).

Local variety of *thomseni*.

Distinguished from the typical form by the telson and uropod. The telson is at least as long as broad, or even a little longer than broad, the distal portion also slightly longer than broad. The peduncle of the uropod is narrower, the apical margin being only one-quarter the length of the apical margin of telson.

5×2 mm. Slaty-grey.

Localities.—Damaraland: Narebis and Outjo (K. H. B.).

Kaokoveld: Kamanyab (R. F. L. and A. J. H.); Kaoko Otavi (K. H. B.).

When typical Waterberg specimens are placed side by side with specimens from the Kaokoveld the differences are obvious. Nevertheless the latter can be regarded only as a local variety. Among

several specimens from Narebis (a locality intermediate between Waterberg and the Kaokoveld) some are intermediate as regards the length of telson and width of uropods, while a few are definitely of the Kaokoveld form.

Diploexochus damarensis Pann.

1924. *Diploexochus damarensis*. Panning, Beitr. Kennt. Land. Süßwasserf. S.W. Afr., ii, p. 181.

In many respects agrees with *thomsoni*, but the groove on 1st segment slightly longer, extending almost half-way along the thickened margin, which is more strongly reflexed. A slight ridge on under side of epimeron 3 and a slight thickening on 4; the following segments show "nothing remarkable," from which it may be assumed that the transverse ridges, so clearly defined in *thomsoni*, are here absent. The same may be said of the pleurae of segments 3-5.

Pronotum narrow.

Telson half as long again as broad, the distal portion also half as long again as broad, sides incurved, dorsally with medio-longitudinal keel.

Antenna 2, 2nd flagellar joint 4 times 1st.

Uropod, outer and inner rami both very small, twice as long as wide.

Locality.—Damaraland: Neudamm, near Windhoek (Panning).

I have seen no examples referable to this species. The type material should be compared with that of *longipes* and *quadrinaculatus*.

Diploexochus kaokoensis n. sp.

(Fig. 55.)

Surface minutely squamulose-granulose. Rugae obsolete. Epistome not demarcated from dorsal surface of head except at the sides, convex above, biconcave below for the reception of the 2nd antennae.

Peraeon segment 1 quite smooth on anterior margin. Epimeral margin thick, reflexed, grooved for nearly its whole length, the whole groove visible externally in side view, hind corner unequally cleft, internal tooth rounded. Internal tooth on segment 2 small, oblique.

Pronotum very narrow, $\frac{1}{15}$ of dorsal length of segment.

Epimera of segments 5-7 with faint oblique or transverse ridge on lower surface.

Pleurae of pleon segments 3-5 with a similar ridge.

Telson broader than long, distal portion short, rectangular, sides and apical margin straight, dorsal surface evenly convex.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle as broad as long, apically broadly subquadrate, outer ramus very small, inner ramus extending almost to apex of telson, about 4 times as long as broad.

Up to 5×1.75 mm. Slaty-grey, eyes black.

Locality.—Kaokoveld: Kaoko Otavi (K. H. B.).

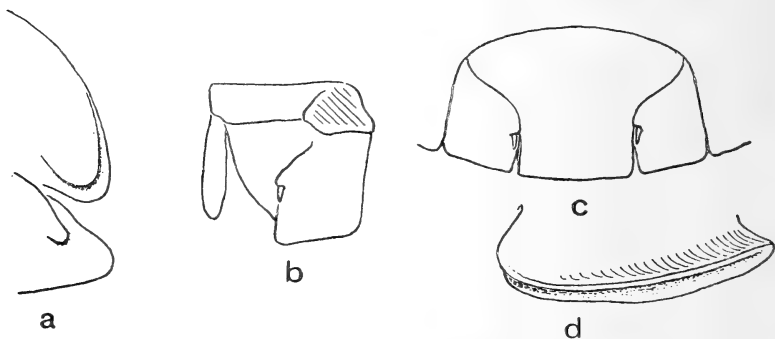


FIG. 55.—*Diploexochus kaokoensis* n. sp. a, Ventral view of epimera 1 and 2; b, dorsal view of uropod; c, telson and uropods; d, external lateral view of epimeron 1.

The complete obliteration of the dorsal margin of the epistome, except for a short distance at the sides, is distinctive. This feature, the completely grooved margin of 1st segment, broad uropod, and short rectangular distal portion of the telson easily distinguish this species from *thomsoni*.

Diploexochus saldanhæ n. sp.

(Fig. 56, c-e.)

Strongly convex. Rugae distinct, tubercular, on the peraeon segments arranged in 2 transverse rows, the anterior row on segment 1 with 4 rounded tubercles rather larger than the others, the tubercles on the other segments subequal in size, more elongate; segments 2-7 with the smooth anterior portion sharply divided from the raised, tuberculate, posterior portion. Pleon segments 3-5 with a series of rounded granules distally.

Epistome scarcely raised above level of head, convex above, deeply biconcave below. Eyes well developed, marginal.

Peraeon segment 1 with margin thick, grooved throughout its length, hind corner equally cleft, internal tooth rounded. Internal tooth on segment 2 well developed. Epimeron of segment 2 narrowed distally.

Pronotum about $\frac{1}{15}$ — $\frac{1}{12}$.

Segments 5–7 with transverse ridge on lower surface.

Telson half as wide again as long, distal portion short, sides slightly incurved, apical margin straight, slightly reflexed, dorsally with 2 submedian rounded ridges or elongate tubercles.

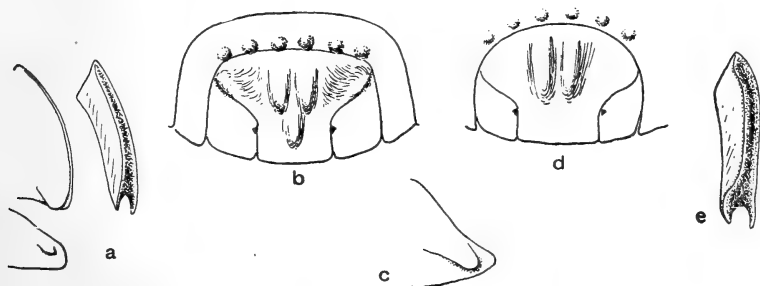


FIG. 56.—*Diploexochus steenbrasi* n. sp. *a*, Ventral view of epimera 1 and 2, with marginal view of epimeron 1; *b*, 5th pleon segment, telson, and uropods. *D. saldanhae* n. sp.: *c*, ventral view of epimeron 2; *d*, 5th pleon segment, telson, and uropods; *e*, marginal view of epimeron 1.

Antenna 2 short and stout, 2nd joint slightly longer than 4th, flagellum equal to 4th joint, its 2nd joint 3 times 1st.

Uropod, peduncle as broad as long, apically subquadrangular, outer ramus minute, inner ramus short, twice as long as broad, extending half-way to apex of telson.

4.25 × 1.75 mm. Pale greyish, hind margins of peraeon segments often darker, eyes dark.

Locality.—Cape Province: Saldanha Bay (K. H. B., 1912).

This species would appear to be close to, but distinct from, *orbicularis*. Budde-Lund's original description states, *inter alia*, "sublaevis" and "oculi parvi"; both of which features do not fit the present specimens.

Found under stones, sometimes, but not always, in conjunction with ants.

Diploexochus steenbrasi n. sp.

(Fig. 56, *a*, *b*.)

Similar to *saldanhae*, but peraeon segment 1 with the cleft at hind corner not so wide, internal tooth on segment 2 smaller, peraeon

segments 5-7 without inferior ridge, telson with a third elongate median tubercle distal to the 2 proximal ones, inner ramus of uropod extending $\frac{2}{3}$ to apex of telson.

3.5 × 1.5 mm. In alcohol, pale cream.

Locality.—Cape Province: Mouth of Steenbras River, south of Gordon's Bay (W. F. P.).

A species obviously allied to *saldanhae*. I have seen only one specimen.

Diploexochus nigricans (Brdt.).

(Fig. 57, a, b.)

1833. *Cubaris nigricans*. Brandt, Conspect. Onisc., p. 191 (29).
 1885. *Armadillo* „ Budde-Lund, Crust. Isop. Terr., p. 22.
 1904. „ „ *Id.*, Rev. Crust. Isop. Terr., p. 114, pl. ix,
 fig. 42.
 1910. *Diploexochus* „ Stebbing, Gen. Cat. S. Afr. Crust.,
 p. 445.

Strongly convex. Surface minutely granulate. Rugae distinct; peraeon segment 1 also with a low median boss on anterior margin, often divided into two, but sometimes almost obsolete. Epistome not strongly raised.

Peraeon segment 1, groove extending at least half-way along margin, often $\frac{2}{3}$ or $\frac{3}{4}$, hind corner not very unequally cleft, internal tooth extending nearly to hind corner, rounded; internal tooth on segment 2 well developed and prominent, but not large.

Pronotum $\frac{1}{10}$.

Usually no ridge on under-surface of epimera of segments 6 and 7, but sometimes a very slight one.

Telson distinctly broader than long, apical margin almost straight, sides incurved dorsally, with 2 low rounded tubercles proximally, followed by a low medio-longitudinal elongate tubercle; ventrally grooved only at base.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint 3-4 times 1st.

Uropod, peduncle slightly longer than broad, apex subquadrangular, distal outer angle very little rounded, outer ramus small, extending scarcely half-way to apex of peduncle, inner ramus short and stout, extending half-way to apex of telson.

Up to 9 × 4 mm. Dark slaty-grey or blackish, uniform but the rugae usually lighter, and the uropods often pale brownish or reddish.

Localities.—Cape Province: Cape Town and Port Elizabeth (Budde-Lund); Cape Town, slopes of Signal Hill, Devil's Peak, and Table Mt. (W. F. P., R. M. L., and K. H. B.); Riebeck Kasteel (K. H. B.); Helderberg, Somerset West (K. H. B.); Tulbagh Poort (W. F. P.); Touws River (R. M. L.); Ceres (W. F. P., R. M. L., and K. H. B.); Matjesfontein (R. M. L.); Slanghoek (W. F. P.); Brandvlei, Worcester (W. F. P.); Hottentots Holland Mts. (K. H. B.); French Hoek Pass (K. H. B.); Houw Hoek (W. F. P.); Gt. Winterhoek Mts., Tulbagh (K. H. B.); Matroosberg, Hex River Mts. (K. H. B.); Tradouw Pass, Swellendam (K. H. B.); Keeromberg, Worcester (K. H. B.); Langeberg Mts. at Garcia's Pass, Riversdale (K. H. B.); Fore Bay, near Mossel Bay (K. H. B.); Robinson Pass, Outeniqua Range (K. H. B.); Wilderness, near George (K. H. B.); Avontuur (W. F. P.).

It may be possible later when considerably more material has been obtained from intervening localities, to distinguish local varieties. Thus the Ceres specimens have the margin of peraeon segment 1 particularly well grooved; those from Keeromberg and the north side of Garcia's Pass have the rugae unusually distinct. In the Fore Bay specimens there are traces of an incipient development of tiny tubercles on pleon segments 3-5, which is definitely recognisable in the Wilderness specimens. Here there are 6 tubercles on both segments 3 and 4, and 4 on segment 5. This form, if it stood alone without the intermediate Fore Bay form, would probably be regarded as a distinct species.

At present only one form is sufficiently outstanding to merit a varietal name, viz.:

nigricans var. *major* n.

Distinguished from the typical form only by the presence of a distinct (but not strong) ridge on lower surface of epimera of segments 5-7, and by its larger size: 11×5 mm.

Localities.—Cape Province: Caledon (W. F. P.); Bredasdorp (R. F. L.).

Diploexochus pachytos n. sp.

(Fig. 57, c.)

Resembling *nigricans*, but with the margin of segment 1 more strongly reflexed, in consequence of which the internal convexity, culminating in the internal tooth, is very prominent. In other words, the hind part of the marginal groove, and the cleft, are much wider

than in *nigricans*. The two proximal tubercles on the telson are somewhat elongate.

8 × 4 mm. Slaty-grey, uropods often pale or reddish.

Locality.—Cape Province : Wellington Mts. (K. H. B.).



FIG. 57.—*Diploexochus nigricans* (Brdt.). *a*, Telson and uropods; *b*, ventral view of epimera 1 and 2, with marginal view of epimeron 1. *D. pachytos* n. sp.: *c*, marginal view of epimeron 1. *D. dollfusi* n.n.: *d*, telson and uropods; *e*, marginal view of epimeron 1.

Diploexochus dollfusi nom. nov.

1895. *Armadillo nigricans*. Dollfus, Mem. Soc. Zool. Fr., viii, p. 345, fig. 1 (*non* Brandt-Budde-Lund).

Surface minutely granulate. Rugae moderately distinct. Epistome not strongly raised.

Peraeon segment 1 with marginal groove not extending so far forwards as in *nigricans*, and the hind corner more unequally cleft; internal tooth on segment 2 as in *nigricans*. Epimera of segments 6 and 7 without ridge on lower surface.

Telson only slightly broader than long, sides incurved, apical margin slightly convex, dorsally as in *nigricans*, but the basal tubercles less conspicuous, the median keel longer and more distinct.

Uropod, peduncle distinctly narrower than in *nigricans*, the distal outer angle more rounded, outer ramus minute, inner ramus longer than in *nigricans*, extending half-way to apex of telson.

Up to 7 × 3 mm. Dark slaty-grey, legs and uropods pale.

Localities.—Cape Province : Cape Flats at Wynberg and Diep River, Cape Peninsula (W. F. P.); Noordhoek Flats, Cape Peninsula (K. H. B.).

I have seen only a few specimens of this form, which is evidently the same as that figured by Dollfus, and differs from the specimens identified by Budde-Lund as *nigricans*.

Diploexochus mixtus (B.-L.).

(Fig. 58, a, b.)

1904. *Armadillo mixtus*. Budde-Lund, Rev. Crust. Isop. Terr., p. 113.

Surface minutely granulate. Rugae distinct, though not very obvious medio-dorsally. Anterior margin of segment 1 with 2 low rounded tubercles. Epistome not strongly raised.

Peraeon segment 1 with margin thick, reflexed, grooved throughout its length, hind corner unequally cleft, internal tooth rounded. Internal tooth on segment 2 well developed, somewhat oblique.

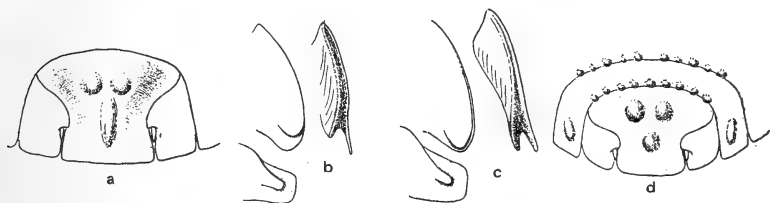


FIG. 58.—*Diploexochus mixtus* (B.-L.). a, Telson and uropods; b, ventral view of epimera 1 and 2, with marginal view of epimeron 1. *D. kogmani* n. sp.: c, ventral view of epimera 1 and 2, with marginal view of epimeron 1; d, 4th and 5th pleon segments, telson, and uropods.

Pronotum $\frac{1}{10}$ ($-\frac{1}{9}$).

Epimera of segments 5–7 and pleura of pleon segment 3 with distinct ridge on lower surface.

Telson a little broader than long, sides incurved, apical margin nearly straight, dorsally with 2 rounded tubercles proximally, followed by a medio-longitudinal rounded ridge.

Antenna 2, 4th joint slightly longer than 2nd, 2nd flagellar joint 3–4 times 1st.

Uropod, peduncle as broad as long, outer ramus small, extending one-third to apex of peduncle, inner ramus short, extending half-way to apex of telson.

9 × 4 mm. In alcohol, unicolorous yellow.

Localities.—Cape Province: Port Elizabeth (Budde-Lund); Avontuur (W. F. P.).

If these Avontuur specimens are correctly assigned to Budde-Lund's species, I would consider *mixtus* more an ally of *nigricans* than a transition between *flavescens* and *festivus*. They have no ridge on the pleura of pleon segment 3, but they are not in very good condition. The outer distal angle of peduncle of uropod is noticeably quadrate.

Diploexochus kogmani n. sp.

(Fig. 58, c, d.)

Surface minutely granulate. Rugae distinct, continuous across the dorsum. Epistome not strongly raised. Anterior margin of segment 1 with 2 median rounded tubercles. Posterior margins of segments with a second transverse series of small tubercles, appreciably smaller than those constituting the ordinary rugae. Segments divided into a smooth anterior portion and a raised posterior portion.

Pronotum $\frac{1}{10}$.

Peraeon segment 1 with margin grooved throughout its length, the groove narrow anteriorly, widening posteriorly, hind corner equally cleft, internal tooth rounded; internal tooth on segment 2 narrow, somewhat oblique.

Epimera of segments 5-7 with slight ridge on lower surface.

Pleon segments 3-5 with feeble tubercles on hind margins, and a well-marked elongate tubercle or ridge on (dorsal surface) each pleura.

Telson broader than long, sides incurved, apical margin slightly convex, dorsally with 3 tubercles, rather broad based, but low and rounded.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint 3-4 times 1st.

Uropod, peduncle broader than long, apex subquadrangular, outer ramus small, extending half-way to apex of peduncle, inner ramus short, broad, extending half-way to apex of telson.

6 × 2.5 mm. Slaty-grey, somewhat mottled.

Locality.—Cape Province: Kogman's Kloof, between Ashton and Montagu (K. H. B., 1922).

Closely allied to *mixtus*, but peraeon segment 1 with a narrower groove on margin, and the hind corner equally cleft, more strongly sculptured, and shape of telson different.

Diploexochus albescens B-L.

(Fig. 59, a, b.)

1909. *Diploexochus albescens*. Budde-Lund in Schultze, Reise, ii, p. 56, pl. v, figs. 29-38.

1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 447.

Surface minutely granulate. Rugae quite distinct. Epistome not strongly raised.

Peraeon segment 1 with margin thick, grooved in posterior half, hind corner unequally cleft, internal tooth rounded; internal tooth on segment 2 subacute, oblique.

Pronotum $\frac{1}{12}-\frac{1}{10}$.

Epimera of segments 4-7 with low oblique ridge on lower surface.

Telson a little broader than long, apical margin almost straight, sides slightly incurved, dorsally smooth.

Antenna 2 slender, 2nd and 4th joints subequal, 2nd flagellar joint 2-2½ times 1st.



FIG. 59.—*Diploexochus albescens* B.-L. a, Telson and uropods; b, ventral view of epimera 1 and 2, with marginal view of epimeron 1. *D. rufescens* B.-L.: c, telson and uropods; d, ventral view of epimera 1-4.

Uropod, peduncle quadrangular, outer ramus minute, inner ramus short, twice as long as broad.

Up to 14 × 7 mm. In alcohol, dirty whitish, eyes dark.

Locality.—Cape Province: Port Nolloth (Budde-Lund and R. M. L.).

The specimens collected by Lightfoot have been compared with Budde-Lund's specimens in the British Museum.

Diploexochus rufescens B.-L.

(Fig. 59, c, d.)

1909. *Diploexochus rufescens*. Budde-Lund in Schultze, Reise, ii, p. 56, pl. v, figs. 12-28.

1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust., p. 447.

Surface minutely squamulose-granulose. Rugae obsolete or almost so, traceable as a series of small feeble granules. Epistome not strongly raised.

Peraeon segment 1 with margin not as thick as in *albescens*, reflexed, grooved in posterior third, hind corner unequally cleft, internal tooth rounded. Segment 2 with a thickening on anterior margin (of

epimeron), but not, or scarcely, forming a definite lamellate flange or tooth.

Pronotum $\frac{1}{10}$, sometimes $\frac{1}{9}$.

Epimera of segments 2-7 with a short, faint, slightly oblique ridge near postero-lateral corner on lower surface.

Telson a little broader than long, distal portion broader than long, sides strongly incurved, apical margin convex, dorsally convex, smooth, sometimes with very faint indications of tubercles proximally.

Antenna 2 slender, 2nd and 4th joints subequal, 1st flagellar joint unusually long, half or a trifle more than half as long as 2nd.

Uropod, peduncle longer than wide, apex subquadrate, outer ramus small, but extending nearly half-way to apex of peduncle, inner ramus very short, twice as long as broad, extending only one-quarter distance to apex of telson.

Up to 13×6.5 mm. Pale dull brownish, the epimera, hind margins of peraeon segments, and whole of pleon darker brown or slaty-greyish, eyes black, antennae pale grey, legs whitish. The contrast between the ground colour and the darker markings is less conspicuous in life than after preservation.

Localities.—Cape Province: Kamaggas (Budde-Lund); Kamieskroon (R. F. L. and A. J. H.); Hell's Kloof, Richtersveld (S.A. Mus.); Springbok and Concordia (K. H. B.); Lilyfontein, Kamiesberg (K. H. B.).

In the specimens in the Budde-Lund collection in the British Museum the 4 tubercles at the base of telson, as shown in Budde-Lund's figure, are generally absent, as they are in most of my specimens. There are, however, sometimes faint indications, and in the single specimen from Hell's Kloof (in poor condition) there are 2 distinct but small granules followed by a faint keel. Except that the telson is also shorter than usual, this specimen is otherwise quite normal.

Diploexochus coloratus n. sp.

Agreeing with *rufescens* except as follows: segments 3-7 with a slight transverse (*i.e.* to body axis) thickening or ridge on anterior portion of lower surface of epimera, in addition to the oblique ridge on the posterior portion; the peduncle of uropod is proportionately stouter, only a little longer than broad (in fact, very like Budde-Lund's fig. 27 of *rufescens*, whereas the typical *rufescens* has a uropod more like fig. 28); and the coloration.

Up to 10×4.5 mm. Ground colour pale cream or white, inner

half of epimera dark slaty-grey or blue-black, joined across the hind margins of each segment by a similar dark band, which is more or less interrupted in the middle, except on segment 1, where it forms a fairly extensive median patch; dorsal parts of pleon, and the telson dark slaty-grey; outer (marginal) parts of epimera, hind margins of each peraeon segment medio-dorsally, the pleurae of pleon segments 3-5, and the uropods suffused with clear orange. Sometimes the orange may extend over the telson, pleon, and a considerable part of the medio-dorsal area of the peraeon. Antennae pale grey, legs white.

Locality.—Cape Province: Kridouw, between Citrusdal and Clanwilliam (K. H. B., 1931).

In life this woodlouse is a most striking animal, and quite distinct from the dull brownish *rufescens*.

Diploexochus flavescens (Brdt.).

(Fig. 60, a-c.)

- | | | |
|-------|-----------------------------|-----------------------------------------------------------------|
| 1833. | <i>Cubaris flavescens</i> . | Brandt, Conspect. Onisc., p. 191 (29). |
| 1885. | <i>Armadillo</i> ,, | Budde-Lund, Crust. Isop. Terr., p. 20. |
| 1904. | ,, ,, | <i>Id.</i> , Rev. Crust. Isop. Terr., p. 111, pl. x,
fig. 5. |
| 1910. | <i>Diploexochus</i> ,, | Stebbing, Gen. Cat. S. Afr. Crust., p.
445. |
| 1917. | <i>Cubaris trilobata</i> . | Collinge, Ann. Nat. Mus., iii, p. 575,
pl. xlii, figs. 1-9. |

Surface minutely granulate. Rugae obsolete. Epistome not strongly raised.

Peraeon segment 1 with margin thick, grooved in posterior third, hind corner unequally cleft, internal tooth strong, rounded-subtruncate. Internal tooth on segment 2 well developed, narrowly rounded.

Pronotum $\frac{1}{16}$ or a little more.

Epimera of segments 5-7 with transverse, somewhat oblique, ridge on lower surface; pleura of pleon segment 3 with a similar ridge.

Telson as broad as long, sides incurved, apical margin slightly convex, dorsally slightly convex at base, and with low medio-longitudinal ridge; ventrally grooved in basal half.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint scarcely twice 1st.

Uropod, peduncle longer than broad, slightly narrower distally,

outer ramus extending half-way to apex of peduncle, inner ramus reaching half-way to apex of telson.

Up to 12×6 mm. Slaty-grey, brownish or greeny-brown, more or less mottled with lighter, antennae grey, eyes black. Young specimens are often more conspicuously mottled. Specimens in alcohol fade through a more or less variegated yellow to a uniform pale yellow or dirty cream.

Localities.—Cape Province: Cape Town and Port Elizabeth (Budde-Lund); Grahamstown (Collinge, also Albany Mus. and W. F. P.); Fort Brown (Albany Mus.); Doornnek, Alexandria Div. (S.A. Mus. ex Drege); Amatola Mts. (W. F. P.); Adelaide (S. H. H.); Zuurborg (Albany Mus.); Bushman's River (Albany Mus.); Addo Bush

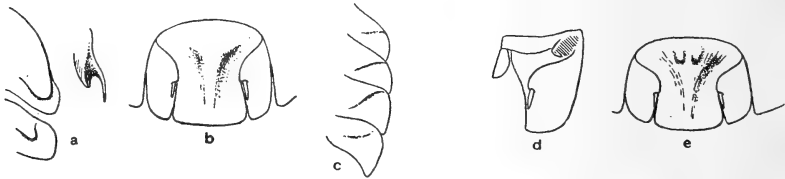


FIG. 60.—*Diploexochus flavescens* (Brdt.). *a*, Ventral view of epimera 1 and 2, with marginal view of epimeron 1; *b*, telson and uropods; *c*, ventral view of epimera 5-7 and pleura of pleon segment 3. *D. festivus* (B-L.): *d*, dorsal view of uropod; *e*, telson and uropods.

(J. D.); Zwartkops, Port Elizabeth (K. H. B.); Avontuur (W. F. P.); Knysna (W. F. P.); Keurbooms River (K. H. B.).

In 1904 Budde-Lund substituted "Cape Town" for "Cape of Good Hope." I doubt whether this species has ever been found actually at Cape Town.

I have seen many specimens from Grahamstown, the type locality of *trilobata*, and find them identical with specimens from Zwartkops and other localities which have been compared with specimens in the Budde-Lund collection. The trilobed inner lobe of maxilla 1 with its 3 plumose setae (Collinge) is either an abnormality or a misinterpretation of a mounted preparation.

The telson often has the distal margin straighter than in Budde-Lund's figure, and I have seen one specimen in which it was slightly concave.

Diploexochus festivus (B-L.).

(Fig. 60, *d*, *e*.)

1904. *Armadillo festivus*. Budde-Lund, Rev. Crust. Isop. Terr., p. 112, pl. ix, figs. 40, 41.

Close to *flavescens*. Rugae present, though obscure, especially in larger specimens; peraeon segment 1 obscurely bituberculate near anterior margin in younger specimens. Internal teeth on segments 1 and 2 as in *flavescens*. Ridge on epimera of segments 5-7 present as in *flavescens*, but often obscure on pleura of pleon segment 3.

Telson a little broader than long, rather more strongly carinate than in *flavescens* and obscurely bituberculate basally.

Uropod, peduncle broader than in *flavescens*, and inner ramus shorter and stouter, extending scarcely more than one-third to apex of telson.

Up to 12×6 mm. Slaty-grey, more or less mottled with lighter.

Localities.—Cape Province: Port Elizabeth (Budde-Lund); Matjesfontein (W. F. P.); Montagu (W. F. P. and K. H. B.); Kogman's Kloof, Montagu (W. F. P.); Touws River (W. F. P.).

The specimens here assigned to this species have the outer distal angle of peduncle of uropod more rounded than in Budde-Lund's figure, and a somewhat shorter and stouter inner ramus. The ridge on pleura of pleon segment 3 is variable, sometimes distinct, sometimes very obscure.

Diploexochus montagui n. sp.

(Fig. 61, a, b.)

Close to *flavescens* and *festivus*, but telson broader than long and distinctly trituberculate; peduncle of uropod stouter than in

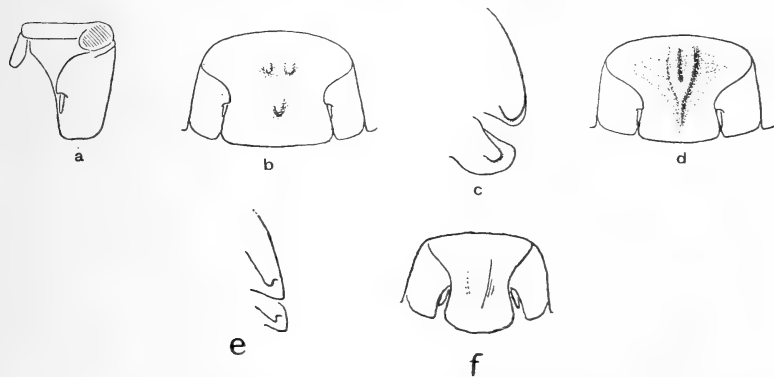


FIG. 61.—*Diploexochus montagui* n. sp. a, Dorsal view of uropod; b, telson and uropods. *D. herscheli* n. sp.: c, ventral view of epimera 1 and 2; d, telson and uropods. *D. oraniensis* (Dollf.): e, ventral view of epimera 1 and 2; f, telson and uropods (e and f after Dollfus).

flavescens, as in *festivus*. Oblique ridges on epimera of segments 5-7 and pleura of segment 3 even more distinct than in *flavescens*.

10 × 4 mm. Slaty-grey, lateral margins and uropods pale.

Localities.—Cape Province : Ashton (W. F. P.); Montagu (K. H. B., 1922).

Diploexochus oraniensis (Dollf.).

(Fig. 61, e, f.)

1895. *Armadillo oraniensis*. Dollfus, Mem. Soc. Zool. Fr., viii, p. 346, fig. 4.

1904. „ „ Budde-Lund, Rev. Crust. Isop. Terr., p. 114, pl. ix, fig. 39.

Rugae ? distinct. Peraeon segment 1 with a single inconspicuous median boss on anterior margin. Epistome not strongly raised.

Peraeon segment with epimeral margin not grooved, hind corner unequally cleft, internal tooth small. Internal tooth on segment 2 well developed.

Pronotum $\frac{1}{12}-\frac{1}{10}$.

Telson a little longer than wide (in figure : very slightly wider than long), sides incurved, apical margin convex, dorsally evenly convex.

Antenna 2, 2nd flagellar joint 4 times 1st.

Uropod, peduncle longer than wide, outer ramus extending half-way to apex of peduncle, inner ramus scarcely extending more than half-way to apex of telson.

7 × 3 mm. Grey with a series of lateral clear spots, uropods red.

Localities.—Orange Free State : Bloemfontein (Dollfus).

Transvaal : Hammans Kraal, near Pretoria (Dollfus).

In having no marginal groove on segment 1 this species resembles the species of *Bethalus*, but it has a narrow pronotum (Budde-Lund, 1904, p. 102). There is certainly a great likeness to *Bethalus pretoriensis*, which has a slightly longer telson and a slightly longer outer ramus of uropod. I have seen no specimens.

Diploexochus herscheli n. sp.

(Fig. 61, c, d.)

Surface minutely granulate. Rugae feebly developed. Epistome only slightly raised.

Peraeon segment 1 with margin thin, reflexed, not grooved, hind corner nearly equally cleft, internal tooth rounded. Internal tooth on segment 2 strong.

Pronotum $\frac{1}{10}$.

Telson broader than long, sides incurved, apical margin slightly

convex, dorsally with median keel which is proximally forked; ventrally with median groove.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint 3-4 times 1st.

Uropod, peduncle as broad as long, apex subquadrangular, outer ramus moderate, slightly beyond half-way to apex of peduncle, inner ramus long, almost reaching to apex of telson.

4.5 × 2 mm. Slaty-grey, mottled.

Locality.—Cape Province: Majuba Nek, Herschel District (Albany Mus.).

The forked sculpture on the telson resembles that of *furcatus*, but in other respects the two species are quite distinct.

Diploexochus orphanus n. sp.

(Fig. 62, a, b.)

Surface minutely granulate. Rugae obsolete. Epistome not strongly raised, convex dorsally, concave ventrally.

Peraeon segment 1 with margin moderately thick, reflexed, narrowly grooved in posterior half, hind corner unequally and narrowly cleft,

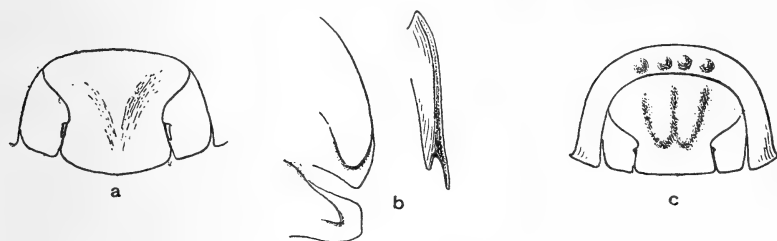


FIG. 62.—*Diploexochus orphanus* n. sp. a, Telson and uropods; b, ventral view of epimera 1 and 2, with marginal view of epimeron 1. *D. alticola* n. sp.: c, pleon segment 5, telson and uropods.

internal tooth rounded. Internal tooth on segment 2 slight, somewhat oblique and subacute.

Pronotum $\frac{1}{10}$.

Telson broader than long, apical portion broader than long, sides slightly incurved, apical margin convex, dorsally with very slight median keel.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint $2\frac{1}{2}$ times first.

Uropod, peduncle longer than broad, apically subquadrate, outer ramus extending half-way to apex of peduncle, inner ramus short,

twice as long as broad, extending scarcely half-way to apex of telson.

Up to 7×3 mm. Slaty-grey, head and the dorso-lateral portions of peraeon segments more or less flecked with paler.

Locality.—Cape Province: Kamiesberg (K. H. B., 1931).

This form was found on the Weeskind (Orphan) Kop, on the western edge of the Kamiesberg, overlooking Garies.

Diploexochus alticola n. sp.

(Fig. 62, c.)

Strongly convex, with low tubercles. Surface with minute squamulae (scale-spines). Head with low granules and corrugations. Eyes well developed. Epistome very feebly raised, in centre almost adnate, dorsally convex, ventrally biconcave for reception of 2nd antennae.

Peraeon segment 1 with 4 rather large, but low and rounded, tubercles or warts on anterior margin, and 2 transverse rows of smaller tubercles behind. Segments 2-7 distinctly divided into a smooth anterior portion and a raised posterior portion, each with 2 transverse rows of tubercles, the hinder row with 14-16 tubercles.

Epimeral margin of segment 1 rather thin, reflexed, grooved only at hind corner, which is unequally cleft, internal tooth rather larger than in *polythele*, rounded. Internal tooth on segment 2 moderate.

Pronotum $\frac{1}{12}$ - $\frac{1}{10}$.

Segments 5-7 with slight transverse ridge on lower surface of epimera.

Pleon segments 3-5 each with a single row of low tubercles, containing 6, 6, and 4 tubercles respectively.

Telson broader than long, posterior portion very short, sides slightly incurved, apical margin straight, dorsally strongly convex, with 2 large, but low and rounded, longitudinal ridges.

Antenna 2 short and stout, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle as broad as long, apex subquadrate, outer ramus minute, inner ramus short, twice as long as broad.

5×2 mm. Pale slaty-grey, eyes black.

Locality.—Cape Province: Zwartberg Pass, Prince Albert Div. (K. H. B., 1929).

In ornamentation and other features (epimeron of segment 1) allied to *formicarum*, but distinguished by the shape of the telson,

the feebly raised epistome, and the uropod. It differs from *polythele* by having the tubercles low and wart-like instead of conically raised.

Diploexochus rhodesiensis n. sp.

(Fig. 63, a, b.)

Strongly convex. Surface minutely squamulose-granulose. Head rugulose. Eyes well developed. Epistome not strongly raised, convex above, biconcave below.

Peraeon segment 1 with 3 large, but low and rounded, bosses in middle of anterior margin, arranged in a triangle, 2 in front and 1 behind, flanked by a similar dorso-lateral boss (often subdivided into 2), with intervening smooth areas; followed by a transverse row

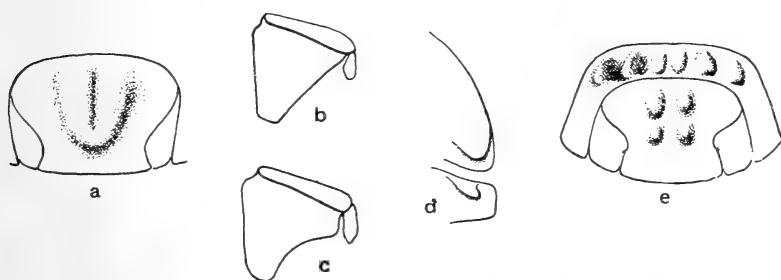


FIG. 63.—*Diploexochus rhodesiensis* n. sp.: a, Telson and uropods; b, ventral view of uropod. *D. pauperculus* n. sp.: c, ventral view of uropod. *D. polythele* n. sp.: d, ventral view of epimera 1 and 2; e, pleon segment 5, telson, and uropods.

of more elongate low tubercles or rugae; posterior margin with a band of small granules.

Epimeral margin moderately thick, reflexed, grooved only in posterior third, hind corner unequally cleft, internal tooth rounded.

Segments 2-7 distinctly divided into a smooth anterior portion and a raised posterior portion, the latter with a transverse row of about 14 low tubercles, followed behind by a band of small granules.

Epimeron of segment 2 subacutely narrowed below; epimera of segments 3 and 4 less narrowed, 5-7 subquadrate, without flange or ridge on lower surface. Internal tooth on segment 2 well developed, but not or scarcely visible externally in lateral view.

Pronotum $\frac{1}{1\frac{1}{2}}$.

Pleon segments 3-5 granulate, without larger tubercles.

Telson $1\frac{1}{2}$ times as broad as long, posterior portion very short, sides incurved, apical margin nearly straight, dorsally with a large

boss covered with small granules and with a medio-longitudinal groove.

Antenna 2 short and stout, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle as long as broad, strongly but evenly narrowed to a truncate apex, inner margin straight, outer ramus obsolete, inner ramus short, twice as long as broad.

Up to 5×2.25 mm. Pale slaty-grey, rugae lighter, eyes dark.

Localities.—Rhodesia : Bulawayo and Salisbury (R. W. E. T.).

Damaraland : Namutoni (K. H. B., 1921).

Great Namaqualand : Nakob (K. H. B., 1925).

The Rhodesian specimens were found in the nests of *Pheidole* ants.

Diploexochus pauperculus n. sp.

(Fig. 63, c.)

Very like *rhodesiensis* except as follows : peraeon segment 1 with only the 2 foremost bosses on anterior margin ; sculpturing in general feebler, and the hind margins of the peraeon segments not distinctly granulate ; peduncle of uropod slightly longer than broad, narrowing to a rounded apex, inner margin concave, inner ramus relatively larger.

5×2 mm. Pale slate-grey, rugae lighter.

Locality.—Cape Province : Fore Bay, near Mossel Bay (K. H. B., 1931).

Found under stones and logs, sometimes in association with ants.

Diploexochus polythele n. sp.

(Fig. 63, d, e.)

Strongly convex and tuberculate. Surface with minute squamulae. Head with 3 transverse rows of conical tubercles, with 8 (or 10), 6, and 4 tubercles in front, middle, and hind row respectively. Eyes well developed. Epistome not strongly raised, convex above, bi-concave below.

Peraeon segment 1 with 4 transverse rows of 4, 3, 14, and 10 conical tubercles respectively, the tubercles of the anterior two and of the posterior two rows alternating. Segments 2-7 distinctly divided into a smooth anterior portion and a raised posterior portion, each segment with 2 rows of about 10 tubercles each, alternating, more or less elongate, especially those of the hinder row on each segment.

Epimeral margin of segment 1 moderately thick, reflexed, grooved only in its hinder third, hind corner unequally cleft, internal tooth rounded. Internal tooth on segment 2 moderate.

Pronotum $\frac{1}{12}-\frac{1}{10}$.

Segments 5-7 without ridge on lower surface of epimera.

Pleon segments 3-5 each with a single row of tubercles, respectively 8, 8, 6, the outermost one on segments 3 and 4 being situate on the pleurae.

Telson broader than long, distal portion very short, sides feebly incurved, apical margin nearly straight, dorsally with 4 tubercles *en caré*.

Antenna 2 short and stout, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle about as broad as long, narrowing to the subquadrate apex, outer ramus obsolete, inner ramus short, twice as long as broad.

4.5 × 1.75 mm. Pale slaty-grey, eyes black.

Locality.—Cape Province: Zwartberg Pass, Prince Albert Div. (K. H. B., 1929).

In ornamentation this species is comparable with *regulus* van Name, 1920, from the Belgian Congo.

Diploexochus meiringi n. sp.

(Fig. 64, a.)

Convex and tuberculate. Surface with minute squamulae. Head with 2 transverse rows of tubercles low rounded, 5 in each row. Eyes well developed. Epistome not strongly raised.

Peraeon segment 1 with 2 transverse rows of low rounded tubercles, 6 in anterior row, the two median ones largest, and 8 in posterior row. Segments 2-7 distinctly divided into a smooth anterior part, and a raised posterior portion, the latter with a transverse row of 16 somewhat longitudinally elongate tubercles, the outermost ones being on the epimera.

Epimeral margin of segment 1 moderately thick, reflexed, grooved along its whole length, hind corner unequally cleft. Internal tooth on segment 2 somewhat narrow and oblique.

Pronotum $\frac{1}{12}-\frac{1}{10}$.

Segments 5-7 with very faint transverse ridges.

Pleon segments 3 and 4 each with 2 rounded tubercles set far apart near junction with pleura, less far apart on segment 4 than on seg-

ment 3; segment 5 with 4 tubercles. The tubercles on segments 3 and 4 together with the outer ones on segment 5 are in two converging lines conforming with the narrowing of the segments. Each pleura with a rather elongate tubercle.

Telson broader than long, distal portion very short, sides feebly or not at all incurved, apical margin nearly straight, dorsally with 3 conical tubercles.

Antenna 2 short and stout, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

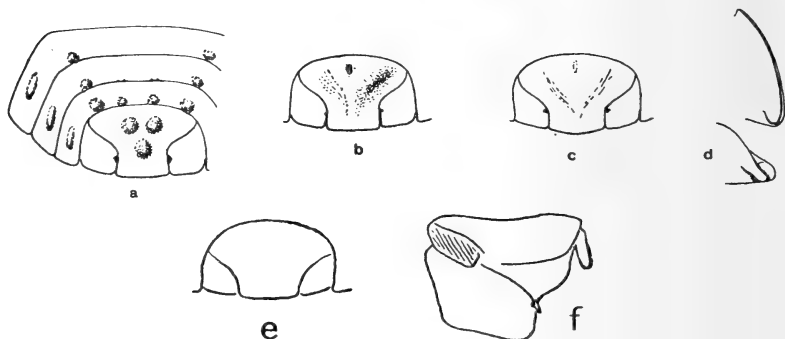


FIG. 64. *Diploexochus meiringi* n. sp. a, Pleon segments 3-5, telson and uropods. *D. alberti* n. sp.: b, telson and uropods. *D. tugelae* n. sp.: c, telson and uropods; d, ventral view of epimera 1 and 2. *D. pusillus* B.-L.: e, telson and uropods; f, dorsal view of uropod. (e and f after Budde-Lund.)

Uropod, peduncle about as broad as long, narrowing to the subquadrate apex, outer ramus minute, inner ramus scarcely twice as long as broad.

5 × 2 mm. Slaty-grey, somewhat rufous on the epimera and pleura, uropods reddish.

Locality.—Meiring's Poort Berg, Zwartberg Range, 6900 ft. (K. H. B., 1932).

Closely allied to *polythele* but with a different arrangement of tubercles, and epimeron of segment 1 grooved throughout its length. The latter feature is found in *alberti*, which, however, is an almost smooth species, the telson in particular showing no trace of any tubercles.

Diploexochus alberti n. sp.

(Fig. 64, b.)

Strongly convex. Surface minutely granulate. Rugae faintly indicated. Eyes well developed. Epistome not strongly raised.

Peraeon segment 1 with margin thick, grooved throughout its length, hind corner equally cleft, internal tooth rounded. Internal tooth on segment 2 well developed, the epimeron narrowed below.

Pronotum $\frac{1}{12}-\frac{1}{10}$.

Segments 5-7 without ridge on lower surface of epimera.

Telson about $1\frac{1}{2}$ times as broad as long, distal portion short, subquadrangular, apical margin straight, dorsally medianly convex, with a faint median impression proximally.

Antenna 2 short and stout, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle a little broader than long, apically subquadrangular, outer ramus minute or obsolete, inner ramus short and stout, twice as long as broad.

6 × 2.25 mm. Slaty-grey, uropods pale reddish.

Localities.—Cape Province: Zwartberg Pass, 5500 ft., Prince Albert Div. (K. H. B., 1929); Meiringspoort Berg, Zwartberg Range, 6900 ft. (K. H. B., 1932).

This form does not appear to be referable to *orbicularis*, as the eyes are by no means small, and the peduncle of uropod is distinctly broader than long.

Diploexochus tugelae n. sp.

(Fig. 64, c, d.)

Surface minutely granulose. Rugae obsolete. Epistome not strongly raised. Eyes well developed.

Peraeon segment 1 with margin grooved throughout its length, hind corner subequally cleft, internal tooth rounded. Internal tooth on segment 2 well developed, oblique.

Pronotum $\frac{1}{12}-\frac{1}{10}$.

Telson broader than long, distal portion very short, sides straight, apical margin slightly convex, dorsally smooth, with a very faint median impression proximally.

Antenna 2 short and stout, 2nd flagellar joint 4 times as long as the very short 1st.

Uropod, peduncle as broad as long, apically subquadrate, outer ramus minute, inner ramus extending almost to apex of telson.

3 × 1 mm. Greyish-white, eyes black.

Locality.—Natal: Krantz kop (K. H. B., 1917).

Differs from *pusillus* in the elongate inner ramus of uropod.

Found in ants' nests under stones. Krantz kop is near the south bank of the Tugela River, which divides Natal from Zululand.

Diploexochus pusillus B-L.

(Fig. 64, e, f.)

1909. *Diploexochus pusillus*. Budde-Lund in Schultze, Reise, ii,
p. 57, pl. v, figs. 39-43.
1910. „ „ Stebbing, Gen. Cat. S. Afr. Crust.,
p. 447.
?1924. „ „ Panning, Beitr. Kennt. Land. Süß-
wasserf. S.W. Afr., ii, p. 167.

Eyes small, ocelli 14. Epistome not strongly raised.

Peraeon segment 1 with margin thick, grooved for its entire length, hind corner subequally cleft.

Pronotum and internal tooth on segment 2 ?

Telson short, almost twice as wide as long, sides slightly incurved, apical margin nearly straight.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle much wider than long, outer ramus minute, inner ramus very small, twice as long as wide, only about $\frac{1}{3}$ length of peduncle.

3.5×1.6 mm. Unicolorous reddish-brown.

Localities.—Cape Province: Cape Flats, near Cape Town (Budde-Lund).

Great Namaqualand: Lüderitzbucht (Panning).

A comparison of Panning's and Budde-Lund's specimens would be useful. As some of the characters were not included in Budde-Lund's description, the identity of Panning's specimens is, to say the least, doubtful.

Diploexochus tabularis n. sp.

(Fig. 65, a-e.)

Surface minutely granulose. Rugae distinct but not prominent, more prominent on segment 7 than anteriorly. Two inconspicuous bosses on anterior margin of segment 1.

Eyes small, 2-3 ocelli. Epistome not strongly raised, a slight median impression above, biconcave below, the junction of the two areas marked by a rather distinct arcuate line.

Peraeon segment 1 with margin grooved throughout its length, but the groove often difficult to trace, hind corner unequally cleft, internal tooth rounded and projecting beyond the true postero-lateral corner of segment, consequently visible externally in lateral view.

Epimeron of segment 2 narrowed to a subacute point, internal tooth well developed, visible externally behind the epimeron in lateral view.

Pronotum $\frac{1}{12}-\frac{1}{16}$.

Segments 2-7 distinctly divided into a smooth anterior portion and a raised posterior portion. Epimera of segments 5-7 with thickening on lower surface near anterior margin.

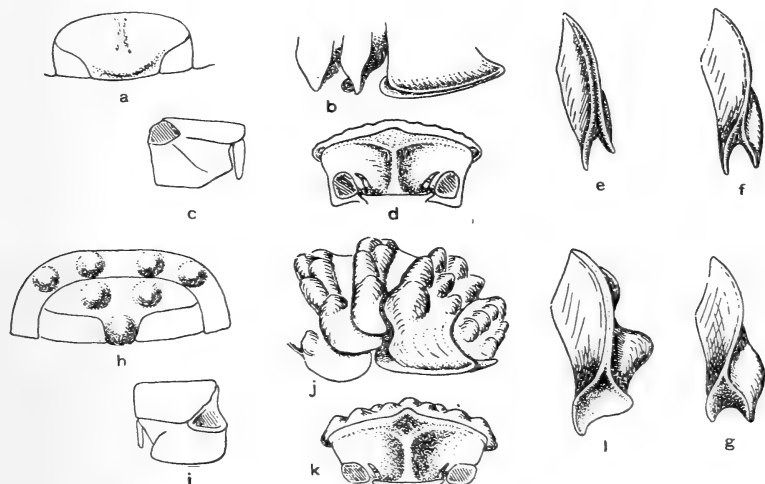


FIG. 65.—*Diploexochus tabularis* n. sp. a, Telson and uropods; b, external lateral view of segments 1-3; c, dorsal view of uropod; d, frontal view of head; e, marginal view of epimeron 1. *D. ecaudatus* n. sp.: f, marginal view of epimeron 1. *D. albanensis* n. sp.: g, marginal view of epimeron 1. *D. hypselos* n. sp.: h, pleon segment 5, telson and uropods; i, dorsal view of uropod; j, external lateral view of head and pereon segments 1-4; k, frontal view of head; l, marginal view of epimeron 1.

Telson twice as broad as long, distal portion extremely short, apical margin nearly straight, dorsally tumid with a faintly indicated medio-longitudinal impression proximally.

Antenna 2 short and stout, 2nd flagellar joint 3-4 times 1st.

Uropod, peduncle much broader than long, subquadrangular, outer ramus obsolete, inner ramus extending to apex of telson and very nearly to level of apex of peduncle.

3 × 1.25 mm. White, eyes black.

Locality.—Cape Province: Table Mt., Cape Town, lower and upper slopes (K. H. B.).

Although found in a locality so close to where *pusillus* was found, I do not think these specimens can be identical with Budde-Lund's

species. He would surely have remarked on the prominent size of the internal teeth on segments 1 and 2 if they were of the same form as here; in fact he says of the 1st peraeon segment "post subaequaliter fisso." Here the hind corner is certainly not subequally cleft. Further, the uropod differs from his figure, and there are fewer ocelli in the eyes. Budde-Lund does not mention the width of the pronotum.

Found among humus and damp leaves, and in ants' nests under stones, from an altitude of about 1000 ft. up to 3000 ft.

Diploexochus ecaudatus n. sp.

(Fig. 65, f.)

Resembling *tabularis* except as follows: ocelli 4 (-5); rugae and tubercles slightly more prominent, on the posterior segments indistinctly divided into two transverse series, with the tubercles alternating in the 2 series; margin of peraeon segment 1 grooved only at hind corner; pleon segments 3-5 with just a hint of tuberculation.

2.75 × 1 mm. Whitish, eyes black.

Localities.—Cape Province: Zwartberg, Caledon (K. H. B., 1918); River Zonder End Mts. (K. H. B., 1928); Langeberg Mts., at Riversdale (K. H. B., 1926).

The specific name may refer to the very short telson, which the species has in common with its allies, and to the "River without End" mountain range. Although the Caledon Zwartberg is now separated from the River Zonder End range, it appears to have been connected with it in the past more intimately than with other mountain massifs. A considerable gap occurs between the River Zonder End and Langeberg ranges; the nearest approximation occurring at Swellendam. No specimens have yet been obtained from the Swellendam area of the Langeberg.

Diploexochus albanyensis n. sp.

(Fig. 65, g.)

Resembling *tabularis* and *ecaudatus* except as follows: all surface sculpturing more rugged; ocelli 5; both the dorsal marginal line and the transverse line across front of epistome more strongly marked and arcuate; rugae and tubercles more strongly developed than in *ecaudatus*; 2 distinct rows of alternating tubercles on each segment, there being 6 tubercles (no median one) in anterior row, and 5 in posterior row, not counting the tubercle at junction of each epimeron and its segment; margin of segment 1 scarcely grooved, but deeply

and widely cleft at hind corner; pleon segments 3-5 each with a transverse series of 3 distinct tubercles (1 median and 1 dorso-lateral on either side); telson with 2 submedian tubercles proximally.

3 × 1.25 mm. In alcohol, greyish, eyes black.

Localities.—Cape Province: Katberg Forest (J. Hewitt, Albany Mus.); Grahamstown (J. Hewitt, Albany Mus.).

Diploexochus hypselos n. sp.

(Fig. 65, *h-l*.)

Resembling *tabularis*, *ecaudatus*, and *albanyensis* except as follows: ocelli not traceable; head, peraeon, and pleon with strong mamilliform tubercles; in 2 series on head and peraeon segments, with 2 median bosses in addition on anterior margin of segment 1; anterior row on peraeon segments with 4 (no median tubercle) and posterior row with 5, not counting the tubercle at junction of epimera and segments; margin of segment 1 thick, but not actually grooved, hind corner widely and unequally cleft; when the animal is completely rolled up, the epimera of both segments 2 and 3 fit into this cleft; internal tooth on segment 2 obsolete, in consequence of the pushing forward of the 3rd epimeron; pleon segments 3-5 each with a single series of tubercles, 2, 4, and 4 respectively, the 2 on segment 3 being especially large (like those on the peraeon); telson more than twice as wide as long, distal portion very short and narrow, dorsally with 3 tubercles, 2 being submedian proximally, the third median on the apical margin, occupying the whole of the distal portion of the telson; antenna 2, peduncle very short and stout, with flagellum only one-third width of 5th joint, shorter than 5th joint, its 2nd joint 3 times 1st; peduncle of uropod as long as broad, the inner basal surface projecting inwards, outer ramus obsolete, inner ramus short, not reaching apex of telson.

3 × 1.25 mm. Creamy-white.

Locality.—Natal: Krantz kop (K. H. B., 1917).

This is the most remarkable species of the *tabularis* group. The suppression of the internal tooth on segment 2 in response to the pushing forward of segment 3 appears to be unique. The telson and uropod are also noteworthy.

In ants' nests under stones. The dorsal sculpturing is not unlike the highland country in the district where this little woodlouse was found.

Diploexochus pubescens (B-L.).

(Fig. 66, a-d.)

1885. *Armadillo pubescens*. Budde-Lund, Crust. Isop. Terr., p. 287.
 1904. „ „ „ *Id.*, Rev. Crust. Isop. Terr., p. 114.
 1910. *Diploexochus* „ „ Stebbing, Gen. Cat. S. Afr. Crust.,
 p. 446.

Strongly convex. Surface distinctly granulate and covered with rather long bristle-like scale-spines. Rugae distinct, and in addition a series of larger granules along hind margins of peraeon segments, covered, however, by the smaller granules and hairs like the rest of the surface.

Eyes well developed. Epistome not strongly raised, convex and minutely granulate above, smooth and concave below.

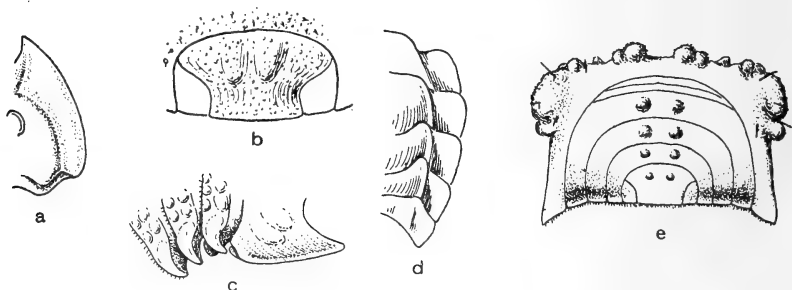


FIG. 66.—*Diploexochus pubescens* (B-L.). a, Ventral view of epimeron 1; b, telson and uropods; c, external lateral view of peraeon segments 1-3; d, ventral view of epimera 5-7 and pleurae 3 and 4. *D. conisaleus* n. sp.: e, hind view of 7th peraeon segment, pleon, and telson.

Peraeon segment 1 with a large, but low, wart-like median tubercle on anterior margin, flanked by a similar but longitudinally elongate one on either side (with intervening smooth area), posterior margin with a series of numerous rounded tubercles. Peraeon segments 2-7 divided into a smooth anterior portion and a raised posterior portion, the latter with 2 transverse rows of tubercles, 14-16 in each row.

Epimeral margin of segment 1 strongly reflexed, not grooved, hind corner subequally cleft, internal tooth rounded. Epimera 2-4 narrowed below to subacute points; internal tooth on segment 2 large, rounded, projecting backwards, visible externally in lateral view, and forming with the apex of its epimeron a cleft into which the 3rd epimeron fits.

Segments 5-7 and pleon segments 3 and 4 with a strong longi

tudinal (parallel with body axis) flange on lower surface, external to which the epimera and pleurae are bent outwards more or less horizontally; the flange is faint on segment 4.

Pronotum $\frac{1}{8}$ – $\frac{1}{4}$.

Telson twice as broad as long, distal portion very short, sides scarcely incurved, apical margin straight, dorsally convex and slightly tumid proximally, with faint indication of a median groove.

Antenna 2 stout, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle longer than broad, apex subquadrangular, outer ramus minute or obsolete, inner ramus $2\frac{1}{2}$ to nearly 3 times as long as wide, extending about half-way to apex of telson.

Up to 11×4.5 mm. Dirty whitish, eyes dark; usually covered with particles of earth.

Localities.—Cape of Good Hope (Budde-Lund).

Cape Province: Grahamstown and environs (Albany Mus.); Kasouga (Albany Mus.).

Natal: Stella Bush, Durban (K. H. B., 1912).

There can be little doubt that this is Budde-Lund's *pubescens*, although he makes no mention of surface sculpturing; in a small specimen this is not too obvious and is more or less concealed by the distinctive hirsute covering. In the following species (*conisaleus*), on the other hand, the tubercles are more prominent, especially those on peraeon segment 7, even in a specimen equal in size to Budde-Lund's specimen, and could not have been overlooked by him.

The only feature in which these specimens appear to differ from Budde-Lund's description is in the epistomè, which was originally described as "frontem multo superante." By comparison with other species the epistome cannot be described as strongly raised above the dorsal surface of the head.

The single original specimen was collected by Drege at the "Cape of Good Hope" (see p. 179). In 1904 Budde-Lund substitutes the exact locality "Cape Town" without any justification.

Diploexochus conisaleus n. sp.

(Fig. 66, e.)

Closely resembling *pubescens*, but distinctly and strongly tuberculate. Surface more squamulose than granulose, and with longer and more hair-like scale-spines; the hind margin of each peraeon segment, however, is clothed with much shorter, bristle-like, scale-spines.

Head with numerous low tubercles. Epimera and pleurae of segments 3 and 4 as in *pubescens*. Peraeon segments 1 and 2-6 as in *pubescens*.

Segment 7 with 2 large rounded submedian tubercles, composed of 2-4 more or less confluent tubercles, and dorso-laterally a relatively enormous rounded boss on each side.

Pleon segments 3-5 each with 2 submedian rounded tubercles.

Telson in shape like that of *pubescens*, but with 2 submedian rounded tubercles proximally, continuing the line of those on pleon segments 3-5.

Antenna 2 and uropod as in *pubescens*, the latter with minute outer ramus.

Up to 9×4 mm. Dirty white, eyes dark; usually covered with particles of earth, so that the sculpture is only seen properly in a freshly moulted specimen.

Locality.—Natal: Inchanga (K. H. B., 1917).

Closely allied to *pubescens* but quite easily distinguished.

Young taken from the brood-pouch are devoid of both tubercles and the hair-like scale-spines. Specimens 2.5 mm. long are tuberculate, but without the conspicuous bosses on segment 7, and are more thickly covered with long hairs than the adults; at 5 mm. these bosses are prominently developed.

Found under stones, with or without ants' nests, and among dead leaves and humus.

Diploexochus makuae n. sp.

(Fig. 67.)

Surface minutely squamulose-granulose. Rugae moderately distinct, but not continuous across dorsum. Epistome strongly raised, convex above, dorso-lateral angles quadrate.

Peraeon segment 1 with margin thick, reflexed, grooved for almost its entire length, hind corner unequally cleft, internal tooth broadly rounded. Internal tooth on segment 2 strong, not adjacent to anterior margin, transverse, subquadrate.

Pronotum $\frac{1}{8}$ - $\frac{1}{7}$.

Segments 3-7 each with transverse ridge anteriorly on lower surface of epimera, and a short longitudinal (parallel to body axis) ridge posteriorly, the latter well marked only on segments 5-7.

Telson broader than long, sides incurved, apical margin nearly straight, dorsally gently convex, with a faint median impression (naked) near base; ventrally with median groove basally.

Antenna 2 short and stout, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle longer than broad, apex subquadrate, outer ramus minute, inner ramus moderate, 3 times as long as wide, extending two-third distance to apex of telson.

7 × 3 mm. Slaty-grey, mottled with paler.

Locality.—Portuguese East Africa : Masiene (R. F. L.).

Closely similar to *salisburyensis* and *obliquidens* in several features, but distinguished by the strong internal tooth on segments 1 and 2,

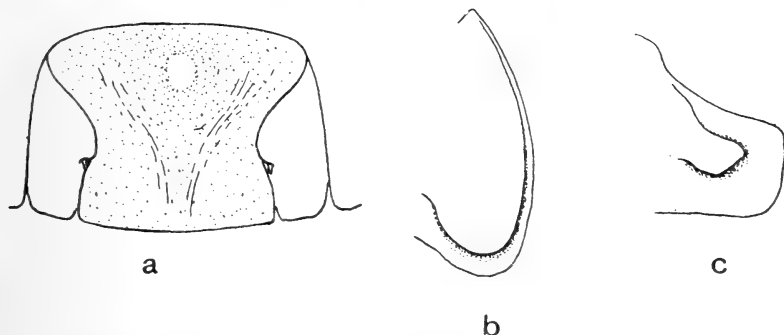


FIG. 67.—*Diploexochus makuae* n. sp. a, Telson and uropods ; b, c, ventral view of epimera 1 and 2.

broader pronotum, and the presence of the longitudinal ridges on lower surface of epimera 3-7.

The rugae of the woodlouse resemble the parallel series of raised cicatrices with which the members of the Makua tribe ornament their faces and bodies.

Diploexochus limenites n. sp.

(Fig. 68, a-c.)

Surface minutely granulate. Rugae on head and peraeon obsolete. Epistome not strongly raised, slightly impressed in front medio-dorsally.

Peraeon segment 1 with margin thin, reflexed, feebly grooved for one-third its length, hind corner very unequally cleft, internal tooth rounded. Internal tooth on segment 2 small, near the anterior margin.

Pronotum $\frac{1}{8}$ - $\frac{1}{7}$.

Segments 5-7 without thickening on lower surfaces of epimera.

Pleurae of pleon segments 4 and 5 with a slight transverse ridge on lower surface ; a similar, but less conspicuous ridge on segment 3 also.

Telson slightly broader than long, apical margin slightly convex, sides incurved, dorsally with 2 faint ridges basally, converging posteriorly (with a minute tubercle between them), followed by a faint short medio-longitudinal ridge ; ventrally without any median groove ; margin above bases of uropods somewhat tumid.

Antenna 2 slender, 2nd and 4th joints subequal, 2nd flagellar joint twice 1st (sometimes scarcely twice).

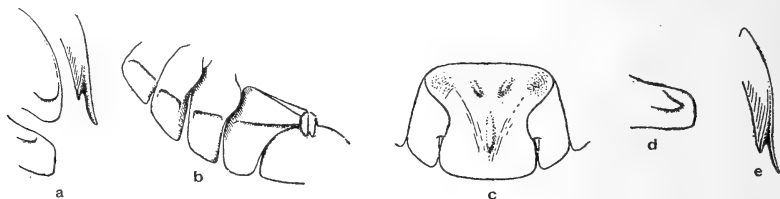


FIG. 68.—*Diploexochus limenites* n. sp. *a*, Ventral view of epimera 1 and 2, with marginal view of epimeron 1 ; *b*, ventral view of pleurae of segments 3-5, uropod, and telson ; *c*, telson and uropods. *D. hypsinephes* n. sp. ; *d*, ventral view of epimeron 2 ; *e*, marginal view of epimeron 1.

Uropod, peduncle apically subquadrangular, ventral surface with a slight transverse ridge, outer ramus short, extending half-way to apex of peduncle, inner ramus very short.

Up to 13×6.5 mm. In alcohol, faded to a uniform cream.

Locality.—Cape Province : Mossel Bay (W. F. P.).

This species and the next one are distinguished from all other South African species by the transverse ridges on lower surface of the pleurae of pleon segments (3) 4 and 5, and the peduncle of uropod.

Diploexochus hypsinephes n. sp.

(Fig. 68, *d*, *e*.)

Differing from *limenites* only in having a distinct groove on peraeon segment 1, extending half-way along margin, the internal tooth on segment 2 stronger, nearer the middle of epimeron, and apically subacute.

Up to 15×7.5 mm. Slaty-grey, more or less mottled with pale cream.

Localities.—Cape Province : Zwartberg Range, at Seven Weeks Poort Berg (Ladismith) ; and the Zwartberg Pass (Prince Albert), 4000-5000 ft. (K. H. B., 1928, 1929).

This form is very close to *limenites*, but the differences are quite clear when specimens of the two forms are laid side by side. Moreover, the respective localities are widely separate, though the intervening country, including the Outeniqua Range, has not yet been searched.

Diploexochus zwartbergensis n. sp.

Distinguished from *nigricans* by the broader pronotum ($\frac{1}{8}-\frac{1}{7}$), the feebler groove on peraeon segment 1, extending only one-third along margin, and the presence of a distinct ridge down the centre of the pleurae of pleon segments 3-5.

8 × 4 mm. Slaty-grey, uropods usually reddish or orange.

Localities.—Cape Province: Zwartberg Range, at Seven Weeks Poort Berg (Ladismith); and the Zwartberg Pass (Prince Albert), (K. H. B., 1928, 1929).

Diploexochus nebulosus n. sp.

(Fig. 69, b, c.)

Resembling *nigricans* very closely, and *dollfusi* still more closely, but distinguished by the broader pronotum and the straight sides of the distal part of telson.

Peraeon segment 1 with margin as in *dollfusi*. Median ridge on telson is quite distinct from the 2 proximal tubercles, not in any way joined to them as it is in *furcatus*.

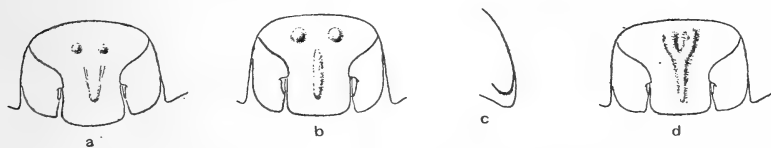


FIG. 69.—*Diploexochus disjunctus* n. sp. a, Telson and uropods. *D. nebulosus* n. sp.: b, telson and uropods; c, ventral view of epimeron 1 (that of *disjunctus* is similar). *D. furcatus* n. sp.: d, telson and uropods.

Peduncle of uropod as broad as long, but narrowed distally, outer distal angle rounded, outer ramus extending half-way to apex of peduncle, inner ramus extending half-way to apex of telson.

6 × 2.5 mm. Slaty-grey, sometimes mottled, uropods often pale.

Localities.—Cape Province: Langeberg Range, at Swellendam and Zuurbrak (K. H. B., 1925).

Diploexochus furcatus n. sp.

(Fig. 69, d.)

Resembling *nigricans* and *dollfusi*, except as follows: margin of peraeon segment 1 thin, grooved only in its posterior third, hind corner unequally cleft; internal tooth on segment 2 smaller and less prominent; pronotum $\frac{1}{2}$; telson with sides feebly incurved, the 2 basal tubercles and the distal median ridge united to form a Y-shaped ridge; inner ramus of uropod longer, extending two-thirds to apex of telson.

5 × 2 mm. Slaty-grey, uropods pale.

Localities.—Cape Province: Palmiet River Mts., Kleinmond (K. H. B., 1927); River Zonder End Mts. (K. H. B.).

The Y-shaped ridge on telson is somewhat like that of *herscheli*, q.v.

Some very similar specimens (S.A. Mus., No. A 7993) were found on Keeromberg, Worcester District, in association with *nigricans*. They are rather less strongly rugulose, the fork on the telson less marked, the tooth on peraeon segment 2 more adnate, and the inner ramus of uropod shorter. Without more material from intervening localities I hesitate either to assign these specimens to *furcatus*, or to regard them as another new species.

Diploexochus disjunctus n. sp.

(Fig. 69, a, c.)

Surface minutely granulate. Rugae distinct. Anterior margin of peraeon segment 1 with 2 feeble rounded tubercles. Epistome not strongly raised.

Peraeon segment 1 with margin thin, grooved only at hind corner which is unequally cleft, internal tooth rounded. Internal tooth on segment 2 rather small, not prominent.

Pronotum $\frac{1}{6}$ – $\frac{1}{5}$.

Telson broader than long, sides incurved, apical margin convex, dorsally with 2 conical tubercles proximally and a median elongate or conical tubercle distally.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle slightly longer than wide, distally narrowed, outer distal corner rounded, outer ramus small, extending half-way to apex of peduncle, inner ramus short, extending half-way to apex of telson.

7 × 3.25 mm. Slaty-grey, sometimes mottled, and uropods sometimes pale.

Localities.—Cape Province : Langeberg Range, at Riversdale (east of Garcia's Pass) and Lemoenshoek (K. H. B., 1926, 1927).

Near to *furcatus* but with slightly broader pronotum and the median tubercle on telson quite separate from the 2 basal ones. The resemblance to *Bethalus limbatus* is very close, but the size and position of the internal tooth on segment 1 is an easy mark of distinction.

Diploexochus castor n. sp.

(Fig. 70.)

Surface minutely squamulose. Rugae tubercular. Head dorsally with 3 transverse rows of rounded tubercles. Epistome not strongly raised.

Peraeon segment 1 with 4-5 transverse rows of rounded or somewhat longitudinally elongate tubercles, the rows not always clearly

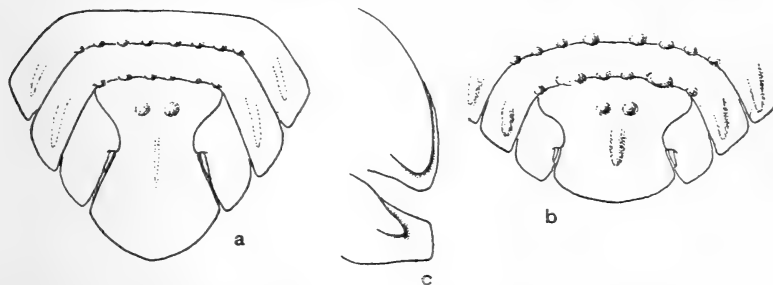


FIG. 70.—*Diploexochus castor* n. sp. a, Pleon segments 4 and 5, telson and uropods of ♂; b, the same of ♀; c, ventral view of epimera 1 and 2.

distinct from one another, about 12-14 tubercles in each row. Segments 2-7 divided into an anterior smooth portion and a raised posterior portion, the latter with 3 transverse rows of tubercles, the hindmost row of each segment on the hind margin, which thus has a scalloped appearance. Upper surface of epimera of segments 2-7 each with 1-3 tubercles.

Epimeral margin of segment 1 not thick, reflexed, grooved in posterior half, but the groove faintly traceable to about two-thirds length, hind corner unequally cleft, internal tooth rounded. Internal tooth on segment 2 small, oblique, subacute.

Segments 3-7 with a slight transverse (to body axis) ridge on lower surface of epimera.

Pronotum $\frac{1}{8}$.

Pleon segments 1-5 each with a single transverse row of tubercles on hind margin, respectively 6, 8, 10, 8, and 6 in number, and an elongate tubercle or ridge on each pleura.

Telson in ♂ nearly half as long again as wide, sides strongly incurved, apical margin strongly convex, dorsally with 2 rounded tubercles at base followed by a median elongate tubercle or short ridge, all three often very indistinct; in ♀ broader than long, sides strongly incurved, apical margin convex, postero-lateral angles rounded, dorsally with 2 submedian rounded tubercles near base, followed by a median elongate tubercle or short ridge.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle longer than broad, outer distal angle rounded, outer ramus extending half-way to apex of peduncle, inner ramus short, $2-2\frac{1}{2}$ times as long as broad, extending in ♂ one-quarter, in ♀ barely half-way, to apex of telson.

Up to 8×3 mm. Slaty-grey, sometimes with lighter mottling, lateral margins of peraeon, pleon, and apex of telson yellowish, eyes black, antennae grey, legs pale.

Localities. — Cape Province: Lilyfontein and Modderfontein, Kamiesberg (K. H. B., 1931).

Klipvlei, near Garies (A. J. H. and C. T., 1931).

The dorsal sculpture varies somewhat. In most of the ♀♀ the tubercles are strong, either low and rounded or sharply conical; in a few ♀♀, however, they are feebly developed. In most of the ♂♂, on the other hand, the reverse is the case, though some younger ♂♂ are as strongly tuberculate as the ♀♀.

The remarkable development of the telson in the ♂ seems to occur only in fully grown ♂♂, smaller ones resembling the ♀. As there are no structural differences, except the telson and the usually stronger sculpturing of the ♀, and as both forms were found together under the same stones, there is no question that only one, sexually dimorphic, species is present. The telson of the ♂ strongly resembles a beaver's tail.

Diploexochus celsicauda n. sp.

(Fig. 71.)

Surface minutely granulate. Rugae feebly indicated. Epistome not strongly raised, in fact scarcely raised at all in the middle.

Peraeon segment 1 with margin not very thick, grooved in posterior third, hind corner unequally cleft, internal tooth rounded. Internal tooth on segment 2 near anterior margin, slight.

Pronotum $\frac{1}{8}$ – $\frac{1}{7}$.

Telson in ♂ considerably longer than broad, distal portion shield-shaped, sides incurved, apical margin with median point, with the margin on either side straight, dorsally with a high medio-longitudinal keel beginning a short distance from base; in ♀ broader than long, sides incurved, apical margin with a slight point, margin on either side nearly straight, dorsally with a slight medio-longitudinal ridge, not extending above the general level of the dorsal profile.

Antenna 2 slender, 2nd and 4th joints subequal, 2nd flagellar joint twice 1st.

Uropod, peduncle in ♂ longer than broad, in ♀ as broad as long, apically subquadrate, outer ramus extending half-way to apex of

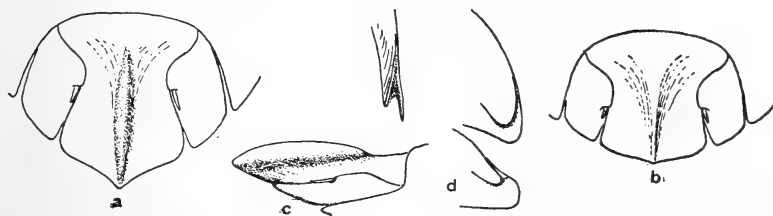


FIG. 71.—*Diploexochus celsicauda* n. sp. a, b, Telson and uropods of ♂ and ♀ respectively; c, lateral view of telson and uropod of ♂; d, ventral view of epimera 1 and 2, with marginal view of epimeron 1.

peduncle, inner ramus short, twice as long as broad, extending in ♀ one-third distance to apex of telson.

Up to 11.5 (♂), 11 (♀), × 4.5 mm. Uniform straw-colour or buff, hind margins of pereaeon segments sometimes (especially in preserved specimens) somewhat darker, eyes black, antennae greyish-brown, legs pale.

Localities.—Cape Province: Van Rhyns Dorp and Bitterfontein (K. H. B., 1931); Garies (A. J. H., 1930).

This species, like *castor*, is remarkable for the sexual dimorphism. In ♂♂ of 4 mm. length the telson is like that of the ♀ with a slightly stronger median ridge; at 5 mm. the telson is a little longer than broad.

Diploexochus longipes B-L.

- | | | |
|-------|--------------------------------|-----------------------------------------------------------------|
| 1909. | <i>Diploexochus longipes</i> . | Budde-Lund in Schultze, Reise, ii,
p. 55, pl. 5, figs. 8–11. |
| 1910. | „ „ | Stebbing, Gen. Cat. S. Afr. Crust.,
p. 446. |
| 1924. | „ „ | Barnard, Ann. S. Afr. Mus., xx,
p. 233. |

Surface minutely squamate. Rugae obsolete. Epistome not strongly raised.

Peraeon segment 1 with margin thin, not grooved, hind corner unequally cleft, internal tooth rounded.

Pronotum $\frac{1}{8}$ (original description) ; $\frac{1}{8}-\frac{1}{7}$ in MSS. conspectus.

Segments 2-7 "duplicatura inferiore epimerorum nulla."

Telson scarcely broader than long, sides strongly incurved, apical margin nearly straight.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint about twice 1st.

Uropod, peduncle longer than broad, outer ramus minute, inner ramus short, twice as long as broad.

10 × 5 mm. In alcohol, yellowish, hind margin of segments with inconspicuous dark spots.

Locality.—Damaraland : Okahandja (Budde-Lund).

On a cursory examination of the Budde-Lund collection in the British Museum, it seemed to me that this species was very likely synonymous with *quadrimaculatus*.

Diploexochus quadrimaculatus B-L.

(Fig. 72, *d*, *e*.)

- | | | |
|-------|---------------------------------------|-----------------------------------------------------------------------|
| 1909. | <i>Diploexochus quadrimaculatus</i> . | Budde-Lund, Schultzes Reise,
ii, p. 54, pl. 5, figs. 1-7. |
| 1910. | „ „ | Stebbing, Gen. Cat. S. Afr.
Crust., p. 446. |
| 1924. | „ „ | Panning, Beitr. Kennt. Land.
Süßwasserf. S.W. Afr., ii,
p. 176. |
| 1924. | „ „ | Barnard, Ann. S. Afr. Mus.,
xx, p. 233. |

Surface minutely squamate. Rugae obsolete. Epistome not strongly raised.

Peraeon segment 1 with margin rather thin, not grooved, hind corner unequally cleft, internal tooth rounded. Internal tooth on segment 2 small.

Pronotum almost $\frac{1}{8}$ (original description) ; $\frac{1}{8}-\frac{1}{7}$ in MSS. conspectus.

Segments 3-7 with a slight thickening on lower surface of epimera.

Telson slightly broader than long, sides strongly incurved, a minute median impression proximally (not mentioned by Budde-Lund).

Antenna 2, 2nd joint shorter than 4th, 1st flagellar joint slightly longer than 2nd.

Uropod, peduncle longer than broad, buter ramus minute, inner ramus very small, not longer than broad (description), twice as long as broad (figure).

11-12 × 5.5 mm. In alcohol, yellow, a series of 4 dark spots on hind margin of the segments.

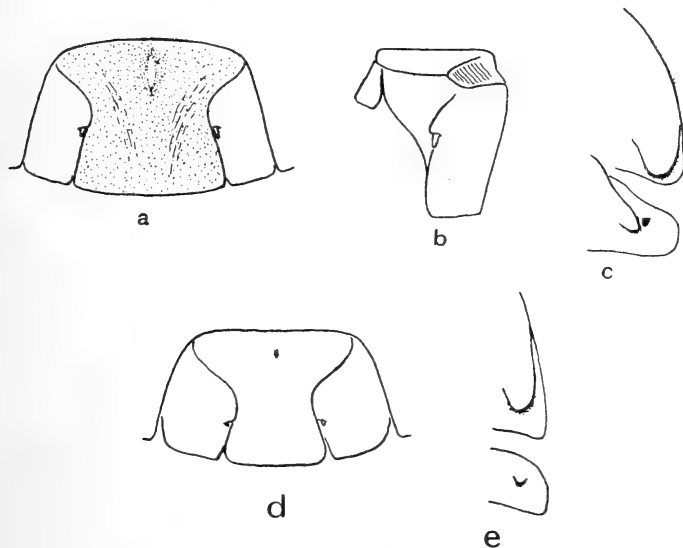


FIG. 72.—*Diploexochus gordoniensis* n. sp. *a*, Telson and uropods; *b*, dorsal view of uropod; *c*, ventral view of epimera 1 and 2. *D. quadrimaculatus* B.-L.: *d*, telson and uropods; *e*, ventral view of epimera 1 and 2. (*d* and *e* from specimen in Budde-Lund collection in British Museum.)

Locality.—Great Namaqualand: Keetmanshoop (Budde-Lund); Kuibis (Panning).

This species, known only from two localities in the southern portion of South West Africa, and *gordoniensis*, which occurs up to the border of South West Africa, are undoubtedly very close. The obviously unequal cleft of peraeon segment 1, however, easily separates them, and the telson is more coarctate here than in *gordoniensis*. Both have the minute bare impression at base of telson.

Budde-Lund in his MSS. conspectus has placed both this species and *longipes* under division 4b. "Pronotum breve, tamen $\frac{1}{8}$ — $\frac{1}{7}$ dorsi vix brevius," thus conflicting with his original descriptions of both species. The length of the 1st flagellar joint is unusual.

Diploexochus gordoniensis n. sp.

(Fig. 72, a-c.)

Surface minutely, but distinctly, granulate, especially on posterior portions of peraeon segments. Rugae obsolete. Epistome not strongly raised, dorsally reflexed.

Peraeon segment 1 with margin thick, reflexed, grooved in posterior half, hind corner subequally cleft, internal tooth rounded. Internal tooth on segment 2 oblique, subacute, but not nearly so strongly separated from epimeron as in, e.g., *thomsoni*.

Pronotum $\frac{1}{6}$ – $\frac{1}{5}$.

Segments 5–7 with slight transverse ridge on lower surface of epimera.

Telson a little broader than long, sides incurved, distal portion also wider than long, apical margin slightly convex, dorsally nearly evenly convex, with a very faint median impression at base (not really impressed, but naked, not covered with the minute squamulae occurring over the rest of the surface).

Antenna 2 not very slender, 2nd and 4th joints subequal, 2nd flagellar joint twice 1st.

Uropod, peduncle longer than broad, apex subquadrate, outer ramus minute, inner ramus very short and stout, scarcely twice as long as broad, extending barely more than $\frac{1}{4}$, at most $\frac{1}{3}$, distance to apex of telson.

Up to 10 × 4 mm. Pale dull brownish, hind margins of segments and dorsal parts of pleon darker brown or slaty-greyish, epimera, pleurae, and distal part of telson usually paler, eyes black, antennae and legs pale.

Localities.—Cape Province: Dyason's Klip, Keimoes, Vaalhoek, north bank of Orange River opposite Kakamas, Zwaardraai, Reimvasmak, Noap Hills, Narugas, Aries, Bak River (K. H. B. and S. H. H., 1925).

Great Namaqualand: Nakob (K. H. B., 1925).

In the shape of the telson and the coloration similar to *rufescens*, but distinguished by the internal teeth on segments 1 and 2, the absence of the *oblique* ridges on lower surfaces of epimera, and the wider pronotum. From *quadrimaculatus*, which also has a wide pronotum, it is distinguished by the subequal cleft of segment 1.

All the above localities are situate in Gordonia, on the north side of the Orange River, Nakob being just over the border in South West Africa; the Bak River and Aries are on the border line.

Diploexochus pilula n. sp.

(Fig. 73.)

Strongly convex, surface very smooth. Rugae quite obsolete. Epistome demarcated above from head only by a very obscure line, front convex above, concave below. Eyes small, ocelli 6.

Peraeon segment 1 with margin thick, reflexed, grooved in posterior half, hind corner equally cleft, internal tooth rounded. Internal tooth on segment 2 small, subacute.

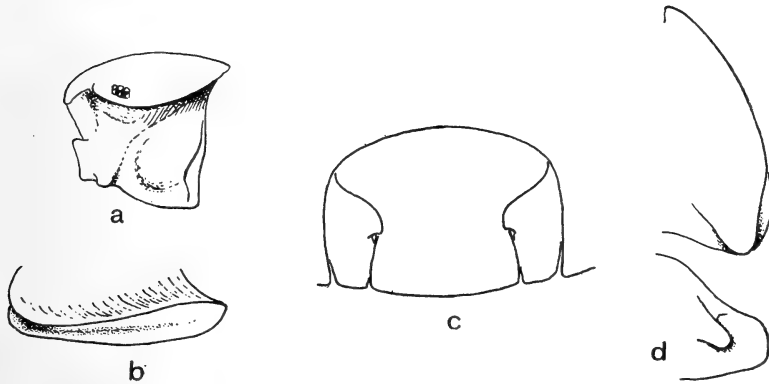


FIG. 73.—*Diploexochus pilula* n. sp. a, Lateral view of head; b, external lateral view of epimeron 1; c, telson and uropods; d, ventral view of epimera 1 and 2.

Pronotum $\frac{1}{5}$.

Telson a little broader than long, sides incurved, apical margin slightly convex, dorsally evenly convex; ventrally with median groove near base.

Antenna 2, 4th joint a little longer than 2nd, 2nd flagellar joint 2–2½ times 1st.

Uropod, peduncle slightly longer than broad, apically narrowed, apex subquadrate, outer ramus minute, inner ramus moderately short, 2½ times as long as broad, extending half-way to apex of telson.

Up to 7 × 2.75 mm. In alcohol, whitish, eyes black.

Locality.—Cape Province: Katberg Forest (J. Hewitt, Albany Mus.).

Resembling *thomsoni* in the feebly demarcated epistome and the thick, reflexed margin of segment 1.

Diploexochus aenigma n. sp.

(Fig. 74.)

Surface minutely granulate. Rugae distinct, but not continuous across dorsum. Epistome not strongly raised.

Peraeon segment 1 with a low triangular boss (obscurely subdivided) in middle of anterior margin. Epimeral margin thick, reflexed, grooved throughout its length, hind corner unequally cleft, internal tooth broad, rounded-truncate, with a small indent. Internal tooth on segment 2 short, transverse, adjacent to anterior margin.

Pronotum broad, one-quarter dorsal length of segment.

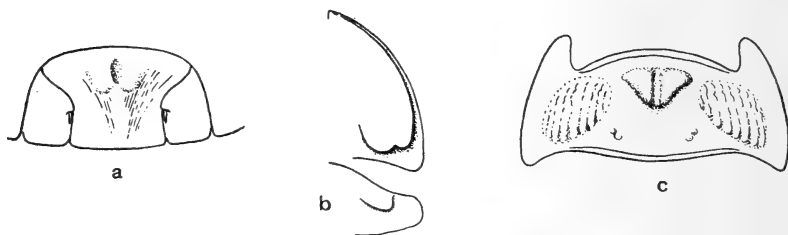


FIG. 74.—*Diploexochus aenigma* n. sp. a, Telson and uropods; b, ventral view of epimera 1 and 2; c, peraeon segment 1.

Segments 3-7 with slight transverse ridge on lower surface of epimera.

Telson broader than long, distal portion subquadrate, sides slightly incurved, apical margin almost straight, dorsally gently tumid at base with a very shallow oval median impression.

Uropod, peduncle about as broad as long, outer ramus short, extending half-way to apex of peduncle, inner ramus long, reaching almost to apex of telson.

9 × 4 mm. Slaty-grey, with a medio-dorsal lighter stripe, pleurae pale.

Locality.—Natal: Stella Bush, Durban (K. H. B., 1912).

This species is close to *burnupi* in external appearance, but distinguished by the dorsal sculpturing and the telson being relatively shorter proportionately to its width.

The width of the pronotum is quite exceptional for a *Diploexochus*, but the species seems to fit into this genus better than into the others.

Diploexochus cingulatus n. sp.

(Fig. 75.)

Strongly convex. Surface minutely granulate. Rugae not strong, but distinct, forming on each segment a transverse slightly raised band continuous across the dorsum. Epistome not strongly raised, slightly reflexed dorsally, biconcave ventrally.

Peraeon segment 1 with 2 slight rounded bosses in middle of anterior margin. Epimeral margin thin, reflexed, slightly costate, hind corner shortly cleft, the outer margin of the internal lamina forming the margin of the epimeron, and visible externally in lateral view. Internal tooth on segment 2 slight, adjacent to anterior margin.

Pronotum on segment 2 slightly less than $\frac{1}{3}$, on posterior segments $\frac{1}{3}$.

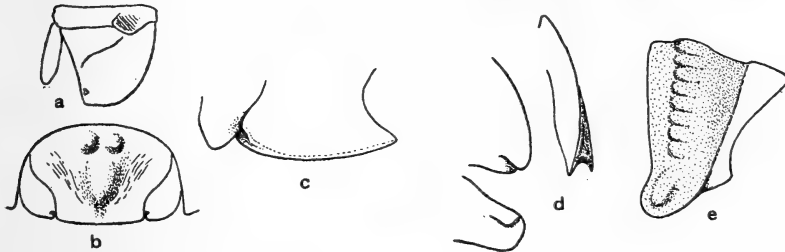


FIG. 75.—*Diploexochus cingulatus* n. sp. a, Dorsal view of uropod; b, telson and uropods; c, external lateral view of epimera 1 and 2; d, ventral view of epimera 1 and 2, with marginal view of epimeron 1; e, lateral view of peraeon segment 3, showing articular surface or pronotum (unstippled).

Telson broader than long, distal portion very short, its sides scarcely incurved, apical margin almost straight, dorsally tumid with 2 low rounded tubercles basally, followed by a similar median one.

Antenna 2 short and stout, 2nd and 4th joints subequal, 2nd flagellar joint 3 times 1st.

Uropod, peduncle stout, as broad as long, outer distal corner rounded, inner margin slightly concave, outer ramus minute, near apex, inner ramus long, 3 times as long as broad, extending almost to apex of telson.

6 × 2 mm. Pale greyish.

Locality.—Natal: Stella Bush, Durban (K. H. B., 1912).

This species is remarkable for the breadth of the pronotum (unless it should be assigned to another genus), the interlocking of the 1st and 2nd epimera, and the position of the outer ramus of uropod.

*Species Cubaridarum incertae sedis an inquirendae.**Diploexochus orbicularis* (B-L.).

1885. *Armadillo orbicularis*. Budde-Lund, Crust. Isop. Terr., p. 23.
 1904. „ „ *Id.*, Rev. Crust. Isop. Terr., p. 100.
 1910. *Diploexochus* „ Stebbing, Gen. Cat. S. Afr. Crust.,
 p. 446.

Strongly convex, "sublaevis." Eyes small, ocelli few. Epistome dorsally adpressed and scarcely raised above level of head.

Peraeon segment 1 with margin thick, grooved, hind corner equally cleft.

Telson much shorter than broad, sides slightly incurved, distal portion very short, transversely concave, apical margin straight, reflexed.

Uropod, peduncle a little longer than broad, outer ramus minute, inner ramus short.

7 × 3.2 mm. In alcohol, uniform blackish.

This species was described from a single defective specimen, supposed to have come from the Cape of Good Hope. In 1904 Budde-Lund quotes the reference to Dollfus and apparently accepts Dollfus' identification. In view of the discrepancy as regards the telson, this interpretation cannot be conceded. Budde-Lund was unable to assign the species definitely to any one of his sections.

Diploexochus liliputanus (Dollf.).

1895. *Armadillo liliputanus*. Dollfus, Mem. Soc. Zool. Fr., viii,
 p. 346, fig. 3.
 1904. „ „ Budde-Lund, Rev. Crust. Isop. Terr.,
 p. 114.

Rugae distinct. Peraeon segment 1 with a median bituberculate boss on anterior margin. Epistome not strongly raised.

Peraeon segment 1 grooved for almost its entire length, hind corner nearly equally cleft (Dollfus' figure), internal tooth truncate or emarginate. Internal tooth on segment 2 well developed.

Telson a little wider than long, sides incurved, apical margin nearly straight, dorsally with 2 low rounded tubercles proximally.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint twice 1st.

Uropod, peduncle as wide as long, outer ramus distinct, not quite reaching apex of peduncle, inner ramus extending two-thirds distance to apex of telson.

4 × 1.75 mm. In alcohol, brown-grey, margin paler, uropods red.

Locality.—Transvaal: Pretoria (Dollfus).

Budde-Lund places this species in his section II = *Diploexochus*, but makes no mention of the pronotal width either in his 1904 or his MSS. conspectus. Both this character and the mandible should be checked on the type material. I have seen no specimens which could be identified with this species.

It resembles *aenigma* in the emarginate internal tooth on segment 1, and perhaps the bituberculate boss on segment 1, but there the resemblance ends; the telson of *aenigma* is shorter, with less incurved sides.

Cubaris natalensis Cllge.

1917. *Cubaris natalensis*. Collinge, Ann. Nat. Mus., iii, p. 573, pl. xli, figs. 11–20.

1920. „ „ *Id., ibid.*, iv, pl. xxvii, fig. 4 (figure shows only 6 peraeon segments).

Body smooth. Epistome not strongly raised apparently.

Peraeon segment 1 with margin grooved for its entire length, hind corner unequally cleft. Internal tooth on segment 2 rather small.

Telson broader than long, distal portion about as long as broad, sides straight, apical margin nearly straight, dorsally evenly convex.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint twice 1st.

Uropod, peduncle longer than broad, apex subquadrate, outer ramus extending half-way to apex of peduncle, inner ramus long, nearly reaching apex of peduncle.

7.5 mm. In alcohol, brown with the positions of the lateral rugae paler.

Locality.—Natal: Krantzkop (Collinge).

Mandible and pronotum not described. From the character of the 1st epimeron the species appears to be almost certainly a *Diploexochus*. The nearest form which I have seen is *aenigma*, but apparently the rugae are not distinct (except by the coloration) in *natalensis*. From the description and figure it is not possible to say whether the internal tooth on segment 1 in *natalensis* has the notch characteristic of *aenigma*.

Cubaris truncatus Cllge.

1920. *Cubaris truncatus*. Collinge, Ann. Nat. Mus., iv, p. 480, pl. xxx, figs. 48–56 (the figure of the whole animal shows only 5 peraeon segments).

Surface finely granulose. Rugae apparently not distinct (except by coloration). Epistome not strongly raised.

Peraeon segment 1 with margin grooved for about three-quarters its length (fig. 54), hind corner unequally cleft. Internal tooth on segment 2 well developed, adjacent to anterior margin (fig. 54).

Telson broader than long, distal portion about as broad as long, sides slightly incurved, apical margin straight, dorsally apparently evenly convex or with a slight median keel proximally (fig. 56).

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint twice 1st.

Uropod, peduncle slightly longer than wide, apex subquadrate, outer ramus extending two-thirds to apex of peduncle, inner ramus rather short.

12.5 mm. In alcohol, yellowish-brown with darker brown dorsally and laterally, flecked with yellow.

Locality.—Cape Province: Port Alfred (Collinge).

I have seen no specimens. The type was stated to be in the Albany Museum, but does not seem to have been returned thither.

Gen. CUBARIS Brdt.

1833. *Cubaris* (part). Brandt, Conspect. Oniscid.

1904. *Armadillo* (part). Budde-Lund, Rev. Crust. Isop. Terr., pp. 97, 118 (section vi).

1909. *Cubaris*. *Id.*, in Schultze, Reise, ii, p. 54 (subgen. of *Armadillo*).

Head concrete, antennary tubercles not distinct, epistome without median raised shield, lateral marginal line of head continuous with margin of epistome.

Pronotum broad, at least one-fifth dorsal length of segment.

Hind margin of peraeon segment 1 more or less sinuate.

Epimera large and thin, margin of 1st more or less reflexed, sometimes grooved, the internal tooth on both 1st and 2nd small.

Mandible with several (at least 4) penicils. Inner lobe of maxilla 1 with 2 subequal slender plumose setae, outer apex rounded.

Peraeopod 1 with groove on anterior surface of 5th joint.

Uropod with oblong peduncle, and well-developed cylindrical outer ramus.

Genotype: *murinus* Brdt.

Excluding the doubtful species referred to this genus by Budde-Lund (1904, p. 120), the genus is distributed over the East Indies, tropical and subtropical East Africa, and the West Indies. Two

African species : *murinus* and *egens*, are included here on the chance that they may be found to occur within our region in Portuguese East Africa.

Key to the African species.

1. Outer and inner rami of uropod short. Telson strongly coarctate. Internal teeth on segments 1 and 2 distinct.
 - a. Margin of peraeon segment 1 with slight keel which ends in the internal tooth *burnupi*.
 - b. Margin of 1st segment not keeled *murinus*.
2. Outer and inner rami of uropod long. Telson slightly coarctate. Internal tooth on segment 1 very small ; none on segment 2 . . . *egens*.

Cubaris burnupi Cllge.

(Fig. 76.)

1917. *Cubaris burnupi*. Collinge, Ann. Nat. Mus., iii, p. 572, pl. xli, figs. 1-10.
1920. „ „ *Id., ibid.*, iv, pl. xxvii, fig. 3.
1920. „ *akermani*. *Id., ibid.*, iv, p. 481, pl. xxx, figs. 57-66.
1920. „ *griseus*. *Id., ibid.*, iv, p. 483, pl. xxxi, figs. 77-85.

Surface minutely granulate. Rugae obsolete ; epimera 2-7 each with a faint transverse ridge on dorsal surface. Epistome not strongly raised, sloping above, with slight median impression.

Peraeon segment 1 with margin reflexed, grooved along its entire length, internal tooth rounded-subtruncate. Internal tooth on segment 2 transverse, adjacent to anterior margin, rounded.

Pronotum about $\frac{1}{4}$.

Segments 3-7 with faint transverse ridge on lower surface of epimera.

Telson slightly wider than long, sides incurved, apical margin slightly convex or almost straight, its width equal to length of telson, dorsally smooth, slightly convex basally with an obscure median granule ; ventrally grooved medianly at base.

Antenna 2, 2nd and 4th joints subequal, 2nd flagellar joint $2\frac{1}{2}$ to nearly 3 times 1st.

Uropod, peduncle apically subquadrangular, outer ramus short, extending about $\frac{2}{3}$ to apex of peduncle, inner ramus twice as long as outer ramus, extending half-way to apex of telson.

Up to 25×12 mm. Dark slaty-grey, with lighter wavy streaks in the position of the rugae, apical portion of 5th joint of antennae pale, eyes black.

Localities.—Natal: Pietermaritzburg and Hilton Road (Collinge); Pietermaritzburg and Krantzkop (K. H. B.); Richmond (S.A. Mus.); Krantzkoop (S.A. Mus.); Eshowe (Albany Mus.); M'fongosi, Zululand (Collinge; also S.A. Mus.); near Pongola River, Zululand (Natal Mus.).

The identity of *akermanni* with *burnupi* seems obvious. The whole figure of *burnupi* given on pl. xxvii, fig. 3, is stated to be $\times 3$, which would make the animal from which it was drawn exactly 23 mm., the same length as given for *akermanni*. This is confirmed by the examination of specimens of *burnupi* and *akermanni*, labelled in Collinge's handwriting, *ex* Natal Museum.

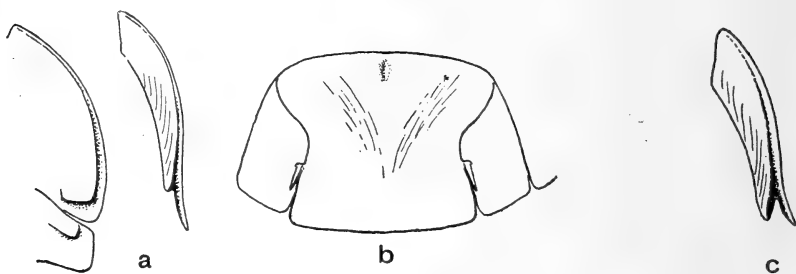


FIG. 76.—*Cubaris burnupi* Cllege. *a*, Ventral view of epimera 1 and 2, with marginal view of epimeron 1; *b*, telson and uropods; *c*, marginal view of epimeron 1 of specimen from Pongola River.

In Collinge's fig. 83 of *griseus*, the artist appears to have represented a very well-marked marginal groove on segment 1, but unfortunately the length of the internal tooth in relation to the postero-lateral angle cannot be seen; apparently it resembles *burnupi*. If, on the other hand, the internal tooth is of the same extent as the postero-lateral angle, *i.e.*, if the hind corner of segment 1 is *equally* cleft, the specimens from the Pongola River might be assigned to *griseus*, because they show a very well-marked marginal groove and an equally cleft hind corner on segment 1 (fig. 76, *c*). This, however, is the only difference between these specimens and typical *burnupi*, and it is scarcely sufficient to justify their separation.

In having a wide pronotum and several penicils in the mandible, this species appears to fall into Budde-Lund's Section vi = *Cubaris*, though at first sight it conflicts with his diagnosis as regards the 1st epimeron. In the present species it is distinctly grooved throughout its length. Only when one reads Budde-Lund's descriptions of *miser* and *proximatus* (1904, pp. 121 and 122) and other species in Section vi,

does one realise that *burnupi* resembles *miser*, etc., and does not therefore conflict with Budde-Lund's conception of *Cubaris*. The difference between "per totam longitudinem sulcato" and "per longitudinem carinato" is merely verbal, for where there is a keel ("in dentem . . . desinens") there must be a more or less marked groove alongside it, or vice versa (cf. *Bethalus macrodens*). Unfortunately Budde-Lund gave no illustration of this feature.

Cubaris murinus Brdt.

(Fig. 77.)

1833.	<i>Cubaris murinus</i> .	Brandt, Conspect. Oniscid.
1885.	<i>Armadillo</i> „	Budde-Lund, Crust. Isop. Terr., p. 27.
1889.	„ <i>javanensis</i> .	Dollfus, Notes Leyden Mus., xi, p. 91, pl. v, figs. 1, a-c.
1895.	„ <i>murinus</i> .	Budde-Lund, Ann. Mus. Civ. Genova, xiv, p. 603.
1904.	„ „	<i>Id.</i> , Rev. Crust. Isop. Terr., p. 119, pl. x, figs. 20-22.
1906.	„ „	<i>Id.</i> , Deutsch. Südpol. Exp., ix, p. 88.

Surface minutely granulose. Rugae on head and peraeon distinct. Epistome moderately raised, with slight median impression above, dorso-lateral angles quadrate.

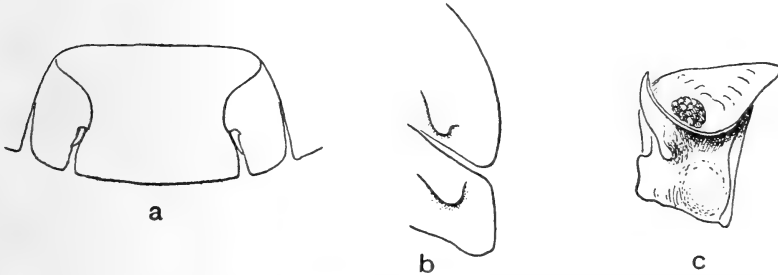


FIG. 77.—*Cubaris murinus* Brdt. a, Telson and uropods; b, ventral view of epimera 1 and 2; c, lateral view of head. (From a Seychelles specimen in the Budde-Lund collection in British Museum.)

Internal teeth on segments 1 and 2 moderately well developed, obtuse.

Telson a little broader than long, apical margin slightly convex, sides strongly incurved, dorsally smooth; ventrally with slight median groove at base only.

Antenna 2, 2nd flagellar joint 2-3 times 1st.

Uropod, peduncle apically subquadrangular, outer ramus short, extending scarcely more than half-way to apex of peduncle, inner ramus short, extending half-way to apex of telson.

Up to 12×6 mm. In alcohol, greyish, uropods pale.

Distribution.—Circumtropical.

This species has not actually been recorded from the region under consideration (lat. 15° S. southwards); the nearest localities are Zanzibar, Seychelles, Madagascar. It occurs on Ascension Island.

The above description and figure are taken from a Seychelles specimen in the Budde-Lund collection in the British Museum.

Cubaris egens (B.-L.).

1904. *Armadillo egens*. Budde-Lund, Rev. Crust. Isop. Terr., p. 124.

Rugae distinct. Epistome not strongly raised, slightly impressed medio-dorsally.

Internal tooth on segment 1 very small, scarcely conspicuous; tooth on segment 2 obsolete.

Telson scarcely broader than long, sides slightly incurved, apical margin straight.

Uropod, peduncle apically broadly rounded, outer ramus long, but not extending to apex of peduncle, inner ramus long, extending almost to apex of telson.

7×3.5 mm. In alcohol, uniformly greyish.

Locality.—Nyassaland (Budde-Lund).

Gen. ANCHICUBARIS Cllge.

1920. *Anchicubaris*. Collinge, Ann. Nat. Mus., iv, p. 484.

1928. „ Jackson, Proc. Zool. Soc. Lond., p. 592.

Head concrete, antennary tubercles not distinct, epistome without median raised shield, strongly raised above level of head, lateral marginal line of head continuous with margin of epistome.

Pronotum narrow, $\frac{1}{9}$ – $\frac{1}{8}$ of dorsal length of segment.

Hind margin of segment 1 sinuate. Epimeral margin of segment 1 thin, not grooved. Internal teeth on segments 1 and 2 well developed.

Epimera and pleurae more or less spread out horizontally.

Antenna 2 short, 2nd, 3rd, and 4th joints subequal, flagellum 2-jointed. Mandible with several penicils (4-6). Inner lobe of maxilla

1 with 2 subequal rather short plumose setae, outer distal angle rounded-quadrate.

Peraeopod 1 with short groove on anterior surface of 5th joint.

Uropod with oblong peduncle and small cylindrical outer ramus.

Genotype : *fongosiensis* Clle.

In the narrow pronotum, short antennae with subequal 2nd-4th joints, and mandibles with several penicils, this form agrees with *Pericephalus*, which contains 3 species from Burma. The 2 plumose setae on inner lobe of maxilla 1 are slightly unequal, but not so definitely unequal as in Budde-Lund's figure of *P. marcidus* (1904, pl. x, fig. 17). Not having seen any specimens of *Pericephalus*, I retain the genus *Anchicubaris*.

Jackson's observation that the 1st antennae are present is confirmed.

Anchicubaris fongosiensis Clle.

(Fig. 78.)

1920. *Anchicubaris fongosiensis*. Collinge, Ann. Nat. Mus., iv, p. 484, pl. xxxii, figs. 86-96.

Strongly convex, with the epistome, pleurae, and telson forming a horizontal flange when the animal is unrolled. Surface minutely squamulose-granulose.

Head with several conical tubercles, 4 in the hinder row. Eyes well developed. Epistome raised considerable above level of head, subquadrangular, nearly twice as wide as high, nearly flat.

Peraeon segment 1 with 4 transverse rows of tubercles, 4 tubercles in the front row, 2 in the next, and about 12 in each of the hinder rows. Segments 2-7 distinctly divided into an anterior smooth portion and a raised posterior portion, the latter bearing 2 transverse rows of tubercles, each with about 12 main tubercles, and also some smaller accessory tubercles or granules. The tubercles are more elongate longitudinally than in Collinge's figure. Epimera 2-7 each with a low transverse ridge.

Epimeron of segment 1 large, spread out horizontally, thin, not reflexed, internal tooth rounded; internal tooth on segment 2 strong, rounded-quadrate.

Pronotum $\frac{1}{3}$ - $\frac{1}{8}$.

Pleon segments 3-5 with a transverse row of respectively 4, 4, and 2 tubercles.

Telson a little wider than long, basal and apical widths subequal,

sides incurved, apical margin nearly straight, dorsally with 2 tubercles near base.

Antenna 2 short and stout, 2nd-4th joints subequal, 2nd flagellar joint $2\frac{1}{2}$ times 1st.

Uropod, peduncle much longer than wide, distal portion with outer and inner margins subparallel, apex rounded-subquadrate, outer

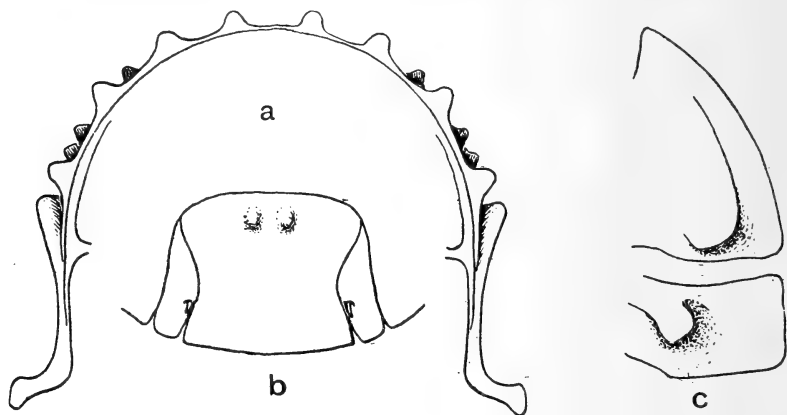


FIG. 78.—*Anchicubaris fongosiensis* Cllge. *a*, Transverse section of segment from middle of pereopod (segment 3 or 4); *b*, telson and uropods; *c*, ventral view of epimera 1 and 2.

ramus short, extending scarcely half-way to apex of peduncle, inner ramus about $\frac{2}{3}$ basal width of peduncle.

Up to 10.5×5 mm. In alcohol, creamy or buff, eyes black; usually covered with particles of earth.

Localities.—Natal: Durban, Winkle Spruit, and M'fongosi, Zululand (Collinge); M'fongosi (S.A. Mus.).

The South African Museum has a large number of specimens, from 3 mm. upwards, collected by Mr. W. E. Jones at M'fongosi. The sculpturing does not vary; young from the brood-pouch measure 2.5 mm. in length.

Gen. ARMADILLIDIUM Brdt.

- | | | |
|-------|------------------------|--------------------------------------------------------------------------|
| 1833. | <i>Armadillidium</i> . | Brandt, Conspect. Oniscid. |
| 1885. | ,, | Budde-Lund, Crust. Isop. Terr., p. 49. |
| 1898. | ,, | Sars, Crust. Norw., ii, p. 188. |
| 1928. | ,, | Jackson, Proc. Zool. Soc. Lond., p. 592,
fig. 19 (structure of head). |

Head concrete, antennary tubercles forming distinct ridges over the antennal sockets, epistome with a median triangular raised shield.

Peraeon segment 1 with epimeral margin simple or more or less distinctly grooved, hind corner not cleft.

Pronotum well developed.

Telson trapezoidal or subtriangular.

Antenna 2 with 2nd joint broader than, but subequal in length to, 4th, flagellum 2-jointed.

Mandible with several penicils. Maxilla 1, outer lobe with 9-10 spines, some of the inner ones feebly bifid, inner lobe with 2 slender subequal plumose setae, outer apex produced in a short acute point.

Peraeopod 1 with groove on anterior surface of 5th joint.

Uropod, peduncle short, not visible dorsally in the gap between telson and 5th pleon segment, this gap being filled by the broad, spatulate outer ramus, inner ramus well developed, cylindrical.

Pleopods 1 and 2 with pseudotracheae.

Genotype: *vulgare* Latr.

This genus is at once distinguished by the peculiar form of the uropods from all other genera except *Eluma* B-L. and *Pareluma* Omer-Cooper, 1923. The latter two genera have the hind corner of peraeon segment 1 slightly cleft; and *Eluma* is distinguished by having each eye composed of a single ocellus.

Armadillidium vulgare (Latr.).

(Fig. 79.)

- | | | |
|-------|-------------------------------|-----------------------------------------------------------------|
| 1804. | <i>Armadillo vulgaris.</i> | Latreille, Hist. Nat. Crust., vii, p. 48. |
| 1885. | <i>Armadillidium vulgare.</i> | Budde-Lund, Crust. Isop. Terr., p. 66. |
| 1898. | „ „ | Sars, Crust. Norw., ii, p. 189, pl. lxxxii. |
| 1906. | „ „ | Webb and Sillem, Brit. Woodlice, p. 41, fig. 57, and pl. xxiii. |
| 1906. | „ „ | Budde-Lund, Deutsch. Südpol. Exp., ix, p. 88. |

Surface smooth and nitidulous, but densely covered with minute scale-spines (see Wahrberg, 1922, p. 7, fig.).

Epimeral margin of segment 1 simple. Pronotum $\frac{1}{3}$.

Telson much broader than long, trapezoidal, apex truncate.

Antenna 2, flagellum subequal to 5th peduncular joint, its 1st joint somewhat shorter than 2nd.

Uropod, outer ramus considerably broader than long.

Up to 17×8 mm. Dark slaty-grey, often almost black, uniform or more or less mottled and variegated with yellowish or brownish, eyes black, legs and antennae dark grey.

Locality.—Cape Province : Cape Town (K. H. B.).

Distribution.—Europe and neighbouring regions of Asia and Africa. Occurs also as an importation in Madeira, N. and S. America, Australia, New Zealand, St. Helena.

This species would appear to be a recent importation into this country. Neither Simon, Schultze, nor the German South Pole

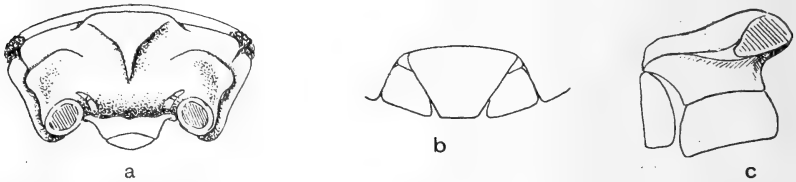


FIG. 79.—*Armadillidium vulgare* (Latr.). *a*, Frontal view of head; *b*, telson and uropods; *c*, dorsal view of uropod.

Expedition collected it. There are no specimens in the South African Museum amongst the material collected by Purcell or Lightfoot. I first noticed it in 1926 in my own garden (in Oranjezicht), where it is now as common as *Porcellio laevis*. It occurs also in the Tamboers Kloof area of Cape Town, but not in the Museum grounds, the Municipal Botanic Gardens, or the National Botanic Gardens at Kirstenbosch.

FAM. EUBELIDAE.

1899. Budde-Lund, Rev. Crust. Isop. Terr., p. 2.

1904. *Id.*, *ibid.*, p. 36.

1907. Richardson, Smithson. Miscell. Coll., vol. 50, p. 220.

1910. Budde-Lund in Sjöstedt, Kilimandjaro-Meru Exp., iii, p. 3.

1912. *Id.*, Ark. Zool., vii, No. 26, pp. 2, 4.

1922. Richardson, Voy. Rothschild Ethiop., i, p. 19.

Head concrete. Flagellum of 2nd antenna 2- or 3-jointed. Inner lobe of maxilla 1 with more than 2 (5-15) plumose setae.

Telson triangular or quadrangular, not or but little exceeding the pleurae of 5th pleon segment.

Uropod with peduncle short and broad, outer ramus small or minute, mostly terminal in position.

The numerous plumose setae on inner lobe of maxilla 1 is a very

distinctive character (fig. 80). Members of this family are found in tropical and subtropical Africa, Madagascar, and one genus is common to West Africa and the West Indies. The nearest recorded locality to South Africa is the Belgian Congo (*Eubelum lubricum*), but it is quite possible that species of this family will be discovered within our

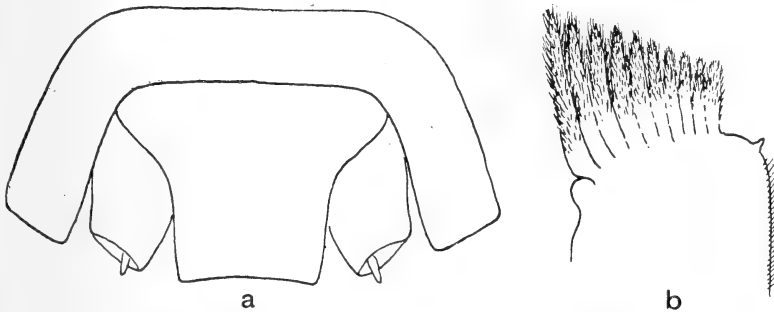


FIG. 80.—*Eubelum lubricum* B-L. Telson and uropods, and apex of inner lobe of maxilla 1 (from Budde-Lund, 1899).

region. It may therefore be useful to include the following synopsis of the genera. *Synarmadilloides*, Nobili, 1926, is not included.

I. Antenna 2, flagellum 3-jointed.

A. Epimeron of segment 1 separated from segment by a groove.

1. Margin of segment 1 sulcate, hind corner cleft *Eubelum* B-L.
2. Margin of segment 1 not sulcate.
 - a. Hind corner cleft *Mesarmadillo* Dollf.
 - b. Hind corner not cleft (or with only a small internal lamina) *Periscyphops* Hilg.

B. Epimeron of segment 1 concrete with segment.

1. Margin of segment 1 sulcate, cleft *Gerutha* B-L.
2. Margin of segment 1 not sulcate, but cleft *Benechinus* B-L.

II. Antenna 2, flagellum 2-jointed.

A. Epimeron of segment 1 discrete.

1. Segment 1 with hind corner cleft { *Ethelum* B-L.
Ethelumoris Rich.
Ignamba B-L.
2. Segment 1 not cleft *Hiallum* B-L.

B. Epimeron of segment 1 concrete. Segment 1 not sulcate, not cleft { *Hiallides* Rich.
Gelsana B-L.

INDEX.

A		PAGE			PAGE
<i>acinosa</i> (Deto)		221	<i>cingulata</i> (Setaphora)		244
<i>aculeatus</i> (Polyacanthus)	180,	321	<i>cingulatus</i> (Diploexochus)		373
<i>aenigma</i> (Diploexochus)		372	<i>circularis</i> (Schöblia)		211
<i>africana</i> (Porcellionides pruinosis			<i>coloratus</i> (Diploexochus)		342
var.)		255	<i>conisaleus</i> (Diploexochus)		359
<i>akermani</i> (Cubaris)		377	<i>contractus</i> (Hiatoniscus)		285
<i>Akermania</i>		318	<i>cordatus</i> (Bethalus)		307
<i>albanyensis</i> (Diploexochus)		356	<i>Cubaris</i>		376
<i>alberti</i> (Diploexochus)		352			
<i>albescens</i> (Diploexochus)		340			
<i>Alloniscus</i>		231			
<i>alticola</i> (Diploexochus)		348			
<i>Anchicubaris</i>		380			
<i>Anchiphiloscia</i>		241			
<i>Angaribia</i>		295			
<i>angolae</i> (Rhyscotus bicolor var.)		287			
<i>angusta</i> (Niambia)		265			
<i>Aphiloscia</i>		238			
<i>Arhina</i>		231			
ARMADILLIDIIDAE		289			
<i>Armadillidium</i>		382			
<i>Armadillo</i>	301, 320, 323,	376			
<i>armata</i> (Deto)		222			
<i>austro-africanus</i> (Trichoniscus)		200			
B			D		
<i>barbertoni</i> (Bethalus)		312	<i>damae</i> (Hora)		230
<i>barnardi</i> (Bethalus)		317	<i>damarensis</i> (Diploexochus)		333
<i>Benthanops</i>		247	<i>damarensis</i> (Niambia)		263
<i>Bethalus</i>		301	<i>demarcata</i> (Setaphora)		244
<i>bicolor</i> (Exzaes)		300	<i>depressa</i> (Kogmania)		209
<i>bicolor</i> (Rhyscotus)		287	<i>Deto</i>		220
<i>braunsi</i> (Phylloniscus)		206	DETONIDAE		219
<i>brunnea</i> (Niambia)		260	<i>dilatata</i> (Ligia)		188
<i>burnupi</i> (Cubaris)		377	<i>dilectum</i> (Philoscia)		238
			<i>Diploexochus</i>		323
			<i>disjunctus</i> (Diploexochus)		364
			<i>dolfusi</i> (Diploexochus)		338
C			E		
<i>capensis</i> (Niambia)		266	<i>ecaudatus</i> (Diploexochus)		356
<i>capensis</i> (Paranotoniscus)		202	<i>echinata</i> (Deto)		221
<i>capensis</i> (Trichoniscus)		199	<i>egens</i> (Cubaris)		380
<i>capensis</i> (Tylos)		218	<i>elongata</i> (Philoscia)		249
<i>castor</i> (Diploexochus)		365	<i>episimus</i> (Hekelus)		298
<i>celsicauda</i> (Diploexochus)		366	EUBELIDAE		384
<i>Cercocyltonus</i>		292	<i>Eubelum</i>		385
<i>cestus</i> (Trichoniscus)		201	<i>eutheles</i> (Phylloniscus braunsi		
<i>chindeensis</i> (Periscyphis)		294	var.)		207
			<i>exotica</i> (Ligia)		192
			<i>Exzaes</i>		299
			F		
			<i>festivus</i> (Diploexochus)		344
			<i>filicornis</i> (Ligia)		186
			<i>flavescens</i> (Diploexochus)		343
			<i>flavescens</i> (Niambia)		262
			<i>fongosiensis</i> (Anchicubaris)		381
			<i>formicarum</i> (Diploexochus)		326
			<i>formicarum</i> (Niambia)		268
			<i>fulleri</i> (Schöblia)		212

Contributions to the Crustacean Fauna of South Africa. 387

	PAGE		PAGE
<i>fulva</i> (Bethanops)	247	M	
<i>furcatus</i> (Diploexochus)	364	<i>macrodens</i> (Bethalus)	311
G		<i>macrops</i> (Gerufa)	276
<i>georgensis</i> (Trichoniscus)	200	<i>major</i> (Diploexochus <i>nigricans</i> var.)	337
<i>Gerufa</i>	272	<i>makuae</i> (Diploexochus)	360
<i>glabrata</i> (Ligia)	190	<i>Manibia</i>	269
<i>gordoniensis</i> (Diploexochus)	370	<i>marginata</i> (Komatia)	240
<i>gracilior</i> (Ligia dilatata var.)	189	<i>marginepapillosa</i> (Niambia)	266
<i>gracilipes</i> (Ligia)	180	<i>marmorata</i> (Gerufa)	277
<i>granulatus</i> (Tylos)	217	<i>marinus</i> (Alloniscus)	232
<i>griseo-albus</i> (Bethalus)	303	<i>Marioniscus</i>	234
<i>griseo-flavus</i> (Niambia)	264	<i>meiringi</i> (Diploexochus)	351
<i>griseus</i> (Cubaris)	377	<i>Metoponorthus</i>	254
<i>griseus</i> (Hiatoniscus)	283	<i>microps</i> (Manibia)	271
H		<i>mina</i> (Setaphora)	242
<i>Hekelus</i>	297	<i>mirabilis</i> (Titana)	208
<i>herscheli</i> (Diploexochus)	346	<i>mixtus</i> (Diploexochus)	339
<i>Hiatoniscus</i>	283	<i>modesta</i> (Niambia)	265
<i>hirsuta</i> (Nahia)	245	<i>monardi</i> (Periscyphis)	295
<i>hirsuta</i> (Niambia)	260	<i>montagui</i> (Diploexochus)	345
<i>hirticornis</i> (Gerufa)	273	<i>montana</i> (Gerufa)	275
<i>Hora</i>	229	<i>montanus</i> (Paranotoniscus)	204
<i>horae</i> (Trichoniscus)	200	<i>moruliceps</i> (Trichoniscus)	199
<i>hottentoti</i> (Trichoniscus)	197	<i>mucidus</i> (Bethalus)	313
<i>Hypergnathus</i>	286	<i>murinus</i> (Cubaris)	379
<i>hypselos</i> (Diploexochus)	357	<i>muscorum</i> (Philoscia)	237
<i>hypsinephes</i> (Diploexochus)	362	N	
I		<i>Nahia</i>	245
<i>Inchanga</i>	277	<i>nanus</i> (Diploexochus)	330
<i>incurvus</i> (Tylos)	218	<i>natalensis</i> (Cubaris)	375
K		<i>natalensis</i> (Inchanga)	278
<i>kaokoensis</i> (Diploexochus)	333	<i>natalensis</i> (Ligia)	191
<i>karongae</i> (Anchiphiloscia)	242, 245	<i>natalensis</i> (Trichoniscus)	198
<i>kogmani</i> (Diploexochus)	340	<i>nebulosus</i> (Diploexochus)	363
<i>Kogmania</i>	208	<i>Niambia</i>	257
<i>Komatia</i>	240	<i>nigricans</i> (Diploexochus)	336
<i>Krantzia</i>	280	<i>nigricans</i> (Diploexochus)	338
<i>kunenensis</i> (Angaribia)	295	<i>nigrinus</i> (Bethalus)	308
L		O	
<i>laevis</i> (Porcellio)	253	<i>obliquidens</i> (Diploexochus)	330
<i>lata</i> (Manibia)	270	ONISCIDAE	224
<i>latifrons</i> (Bethalus)	313	Oniscinae	231
<i>latus</i> (Paranotoniscus)	205	<i>oraniensis</i> (Diploexochus)	346
<i>Ligia</i>	184	<i>orbicularis</i> (Diploexochus)	374
LIGIIDAE	183	<i>orbicularis</i> (Diploexochus)	326
<i>Ligyda</i>	184	<i>ornatus</i> (Paranotoniscus)	205
<i>liputanus</i> (Diploexochus)	374	<i>orphanus</i> (Diploexochus)	347
<i>limbatus</i> (Bethalus)	303	<i>ovampoensis</i> (Diploexochus)	328
<i>limenites</i> (Diploexochus)	361	<i>ovampoensis</i> (Diploexochus)	330
<i>longicauda</i> (Cubaris)	308	P	
<i>longicauda</i> (Niambia)	269	<i>pachyos</i> (Diploexochus)	337
<i>longipes</i> (Diploexochus)	367	<i>pallida</i> (Niambia)	264
<i>lubricum</i> (Eubelum)	180, 385	<i>panurus</i> (Bethalus)	306
		<i>Paranotoniscus</i>	202
		<i>pauperculus</i> (Diploexochus)	350

ANNALS
OF THE
SOUTH AFRICAN MUSEUM

VOLUME XXX.

PART III, containing:

12. *South African Hispinae from the South African Museum, Cape Town.* 43. *Contribution to a knowledge of the Hispinae (Coleoptera, Chrysomelidae).* By E. UHMANN, Stollberg-Erzg. (Translated from the German manuscript.)
13. *Some Insects associated with the Plant Gnidia (Arthrosolen) laxa Gilg.* By A. J. HESSE, B.Sc., Ph.D., F.E.S., Assistant, South African Museum, Cape Town. (With 10 Text-figures.)
14. *On Some Collembola-Arthropleona from South Africa and Southern Rhodesia.* By H. WÖMERSLEY, A.L.S., F.R.E.S.; Entomologist, South Australian Museum. (With 12 Text-figures.)
15. *Reports on the Marine Mollusca in the Collections of the South African Museum.* IX. By J. R. LE B. TOMLIN, M.A., and Dr. F. A. SCHILDER. (With 3 Text-figures.)



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12. *South African Hispinae from the South African Museum, Cape Town.* 43. *Contribution to a knowledge of the Hispinae (Coleoptera, Chrysomelidae).*—By E. UHMANN, Stollberg-Erzg.

(Translated from the German manuscript.)

IN response to my request for material for the study of South African Hispinae, the above Museum forwarded, through Dr. Hesse, numerous Hispinae for examination. A large number of specimens of these, as well as of others not dealt with below, were put into my hands. For this material and for the supplementary information concerning various types I am very greatly obliged.

NEW SPECIES.

1. *Callispa hessei*, Portuguese East Africa.
2. *Callispa nyakaënsis*, Portuguese East Africa.
3. *Dactylispa viatoris*, Rhodesia.
4. *Hispa (Thoracispa) hessei*, Cape Province.
5. *Platypria nodifera* Spaeth, Transvaal.

SYNONYMS.

Pseudhispella consobrina Pér. belongs to *Polyconia spinicornis* Kr.

1. *Callispa hessei* n. sp.

Ovata, fulva, nitida, antennis nigris ad basim fulvescentibus. Capite laevi, prothorace transverso a basi antrorsum rotunde angustato, utrinque lateraliter indistincte impresso, ibi crebre, ceterum sparse punctato; elytris ovatis, convexis, subregulariter punctato-striatis, punctis ante apicem et extus non latioribus, serie marginali exili. Long. 6 mm.

It appears to resemble *C. bottegoi* Gest., a species unknown to me, but certainly differs from it by the oval and not parallel shape and the uniform strength of the rows of punctures on the elytra.

In contour it comes nearest to *kilimana* Kolbe and *silacea* Ws., but is much more coarsely punctured, has stouter antennae, and the head is medially obtusangularly produced between the antennae,

whereas in the species mentioned the head in front is triangularly produced across its entire breadth.

Antennae stout and short, scarcely reaching the posterior margin of the prothorax; joint 3 longer than 2; seen from the narrow side 4 is equal to 5, and is as long as broad; the rest of the joints, excepting the pointed 11th joint, slightly transverse, scarcely differing from each other; joints 5 to 10 become progressively more transverse seen from the broad side. Prothorax with sharp posterior angles, forward from these rounded and narrowed; anterior angles acutely projecting; the sides finely margined; laterally slightly and feebly depressed, covered with fairly strong scattered punctures, which are denser in the region of the lateral depressions. Scutellum smooth, triangular. Elytra with 11 almost regular rows of punctures, of which only the 11th on the lateral margin is very fine, with the punctures in the rest of the rows almost all equal in size; row 1 linear; rows 6 and 7 present only in the posterior half of elytra.

Three specimens. Portuguese East Africa: Lourenço Marques, 18/7/08.

2. *Callispa nyakaënsis* n. sp.

Elongata, parallela, nitida, nigro-cyanea, pedibus abdomineque rufo-testaceis. Capite subtilissime punctulato, triangulariter producto; prothorace transverso, lateraliter leviter, ante scutum profunde impresso, sparse punctato; scuto laevi, pentagonali; elytris parallelis, post humeros impressis, regulariter punctato-striatis, striis a sutura marginem versus punctis fortioribus, stria undecima subtilissima. Long. 5-5.5 mm.

Similar to *C. rufiventris* Uh.; the legs, however, yellow; the body more shiny; the head broadly triangularly produced in front, as in *kilimana* Kolbe and *silacea* Ws.; in *rufiventris* it is simply triangularly pointed.

Very dark blue, smooth, shining; abdomen and legs orange. Head very finely punctured, the extension in front truncated; antennae moderately short, reaching to middle of prothorax, moderately stout, with the basal joints elongate, those towards apex transverse. Prothorax transverse; the sides rounded and narrowed, finely margined; anterior angles not projecting; the disk on each side posteriorly and laterally feebly depressed, with a distinct and deep depression in front of scutellum, with scattered punctures, smooth anteriorly. Scutellum smooth, pentagonal. Elytra parallel, convex, with a shallow, irregular depression behind the shoulders, with 11 regular

rows of punctures, the innermost linearly impressed; the inner rows with fine punctures, towards the sides the punctures in the rows become progressively coarser; row 11 very fine, directly on the lateral margin; rows 5 and 6 begin only at the middle of the elytra.

Three specimens. Portuguese East Africa: Nyaka, 11/1924 (R. F. Lawrence).

3. *Callispa umtalina* Pér. The author states "Tota nigra." Dr. Hesse kindly informs me that the type has a reddish-brown abdomen.

4. *Oncocephala promontorii* Pér. One specimen. South-West Africa: Tsumeb (R. Tucker, December 1919).

5. *Balyana sculptilis* Fairm. Seven specimens. Rhodesia: Sebakwe (D. Dods, 1901).

6. *Pseudhispella militaris* Ws. Five specimens. Rhodesia: Sebakwe.

7. *Pseudhispella consobrina* Pér. Of this species, Dr. Hesse kindly informs me that "there are three specimens, all labelled as types, two from Rhodesia (Sebakwe), and one from the Transvaal (Shilouvane, ex Pér.), of which the last specimen only still has antennae." From the description and figure forwarded to me it follows that this species belongs to *Polyconia*. A comparison with my material of *Polyconia spinicornis* Kr. from the Congo and Cameroons convinces me that *consobrina* is identical with *spinicornis*, and has to be considered as a synonym of it. Two specimens from the Transvaal (Kaapmuiden, R. W. Tucker, 30/10/1918) have been kindly presented to me. They are smaller than my smallest specimens of *spinicornis* from the Cameroons (Uam region). In other respects no specific differences are to be detected.

8. *Dorcathispa alternata* Ws. One specimen each from Portuguese East Africa: Masiene, December 1923, and Inhambane, January 1924 (R. F. Lawrence); one specimen from Rhodesia: Bulawayo, May 17 (R. Tucker).

9. *Dorcathispa extrema* Pér. One specimen from East Transvaal: Komati Poort, November 1918 (R. Tucker); one specimen, South-West Africa: Tsintsobis, January 1920 (R. Tucker); one specimen, Transvaal: Kaapmuiden, 30/10/1918 (R. Tucker); one specimen from Portuguese East Africa: Lourenço Marques, 1911 (T. B. Paulus).

10. *Dactylispa bodongi* Uh. According to the material before me, this species, outside Portuguese East Africa (Beira), also occurs in Zululand, Cape Province (Dunbrody), and in the Transvaal (Pretoria, Komati Poort, and Acornhoek).

11. *Dactylispa sulcata* Chap. One specimen each from the Cape

Flats, 16th December (C. G. H.); Paarl, September 1901 (C. G. H.); Stellenbosch.

12. *Dactylispa gracilis* Pér. Three specimens from Southern Rhodesia (Salisbury), and one specimen from Bulawayo.

13. *Dactylispa perfida* Pér. One specimen from Portuguese East Africa: Nyaka 11/24 (R. F. Lawrence); and 4 specimens from North-East Transvaal: Louis Trichardt, 12/18 (R. Tucker).

14. *Dactylispa pretiosula* Pér. One specimen from Rhodesia: Sebakwe (O. Dods). In my key in "Rev. Zool. Bot. Afr., xxi, 1931," pp. 154 and 155, it comes after *hirsuta* Gest. Intervals 4 and 6 broad, carinate; rows 5 and 6 curved outwards.

15. *Dactylispa viatoris* n. sp. (Pér. in coll.).

Oblonga, nitida, rufo-testacea, prothorace utrinque macula parva nigra, spinis dorsalibus elytrorum nigris, ceteris in apice nigris, prosterno in medio, metasterno fere in totum nigris. Antennis ad apicem vix incrassatis, articulo primo incrassato; vertice opaco, declivi, collo nitido; prothorace dense flavo-sericeo, fere plano, spinis lateralibus 2, 1, duabus anticis inaequalibus, basi subconjunctis; elytris oblongis, regulariter punctato-striatis, tenuissime pilosis, spinis longis, validis, brevissimis intermixtis, in margine apicali abbreviatis. Long. 6, lat. 2.5 mm.

This species, from the hairs on the prothorax, reminds one of *pubicollis* Chap., but has, unlike this species, not smooth elytra, but a small, yellowish hair in each puncture. It is to be placed near *echinata* Gyll., from which it differs in size and the finer hairs on the elytra.

Reddish-brown; pro- and metasternum black in part; prothorax on each side with a black spot. Head with the vertex plane and flat, with only a short groove posteriorly, with golden yellow hairs on eye margins, steeply sloping to the shining neck; clypeus longer than broad, wrinkled, distinctly carinate between the eyes. Antennae half as long as the body, not compressed, scarcely thickened apically; joint 1 stout, twice as long as thick; 2 scarcely half as long as 1; 3 as long as 1; 4-6 becoming progressively shorter, with 6 one and a half times as long as broad; 7 a little longer than 6; 8-10 of equal size, each only slightly longer than broad. Prothorax transverse, wrinkled and punctured, smooth along the middle line and on the black spots, densely covered with golden yellow hairs as in *pubicollis*; spines 2 and 1 on lateral margins, with the two front ones very close together, scarcely separated at the basis, the first shorter than the second, with

the third free spine large, half as long as the second. Elytra twice as long as broad, regularly punctato-striate; rows 9 and 10 shortly connected in the middle, in each puncture a fine small golden-yellowish hair; discal spines stout and long, everywhere intermixed with very short ones; interval 2 with 5 spines (2 before and 3 behind the middle); interval 4 with 3 spines (1 at the level of the shoulders, 1 in the middle and 1 in front of the last spine on interval 2); interval 6 with 4 spines on the humeral callus, a 5th immediately behind it, a 6th at the middle next to the 2nd spine on interval 4 in front of the distinct depression, a 7th behind the depression between the 3rd and 4th spines on interval 2; interval 8 with one spine on the outer angle almost next to the last spine on interval 6; spines on lateral margins numerous (12-15), almost as long as those on the disk; spines on the hind margin short, triangular.

Two specimens labelled with an upper label * "A. C. W. Mally, Agrl. Dept., Grahamstown, Cape Colony, 5/12/10," and a lower label, "J. B. Greathead, Fort Jamieson, N.E. Rhodesia, 23/8/10."

16. *Dactylispa discreta* Ws. Two specimens each from Portuguese East Africa: Nyaka, Masiene and Inhambane; Natal: Malvern.

17. *Dactylispa pubicollis* Chap. (*dissimilis* Pér.). One specimen each from Natal: Malvern; Transvaal: Louis Trichardt (R. F. Lawrence, 1/11/28); Portuguese East Africa: Nyaka (R. F. Lawrence, 11/24).

18. *Trichispa sericea* Guér. Four specimens from Natal: Durban (C. N. Barker, 24/10/18).

19. *Hispa (Chrysispa) fera* Ws. Two specimens from Zululand: Mfongosi (W. E. Jones, 3/17). New for South Africa.

20. *Hispa traversii* Gest. Twelve specimens from Portuguese East Africa: Nyaka (R. F. Lawrence, 11/1924). This species, described from Abyssinia, has a wide distribution. I have also been able to record it from the Congo and Lower Guinea.

21. *Hispa ovampo*a Pér. One of the specimens presented to me (N. Rhodesia: Pemba, Father Casse, 1917) resembles a *quadrifida* Gerst. The elytra, however, have a bronzy lustre. Unfortunately the antennae are wanting, so that it is impossible to establish whether they afford yet another character for the separation of the two species.

22. *Hispa melancholica* Ws. One specimen from Mashonaland:

* The upper label is not a locality label but merely signifies that the specimen is from Dr. Mally's collection when he was in the Agricultural Department. The true locality of the species is thus Fort Jamieson, N. Rhodesia.—EDITOR.

Salisbury (G. A. Marshall, 1894) Ex cotype; elytra brownish-metallic, certainly immature. Supposed by Péringuey to be a new species *pulchella* (nom. in coll.).

23. *Hispa indubia* Pér. Three specimens from Transvaal and 1 specimen from Rhodesia: Sebakwe. This species is very similar to *bennigseni* Ws., and most likely only a southern race of it. It differs by the much shorter elytral spines; particularly short are the spines on intervals 2 and 4 and along the lateral margins. In my key (Mitt. Mus. Berl., 1931 (32), p. 884), it comes after *stuhmanni* Uh., with the contrasting character: the 4 spines on the lateral margins of prothorax forming a cross.

24. *Hispa approximans* Pér. One specimen from Southern Rhodesia: Penkridge, 3/28.

25. *Hispa eximia* Pér. Five specimens from Transvaal: Pretoria (1/4/1918, Dr. Brauns).

26. *Hispa pavidia* Ws. One specimen each from South-West Africa: Nuragas (January 1920, R. W. Tucker); Southern Rhodesia: Salisbury (May 1917, R. Tucker). Both these specimens are a little more slender than the typical forms from German East Africa.

27. *Hispa malvernica* Pér. Two specimens from Natal: Scottburg (K. Barnard), and 1 specimen from Malvern. To be placed after *H. caffra* Ws.

28. *Hispa ramulosa* Chap. One specimen each from Stellenbosch (L. Péringuey), Hottentot's Holland Mts., 4000 feet, Caledon, C.P. (K. Barnard, 1916). Besides these there are 2 totally dark brown, immature specimens.

29. *Hispa (Eutrichispa) gebieni* Uh. Fourteen specimens from Portuguese East Africa: Lourenço Marques (J. B. Paulus, 1911); 1 specimen from Bushmanland: Henkries (Lightfoot).

30. *Hispa (Thoracispa) hessei* n. sp.

Elongata, brunnea, spinis a medio ad apicem infuscatis; antennis gracilibus, vix incrassatis; prothorace laevi, subopaco, lateribus valde lobatis, lobo spinulis multis radiatim digestis; elytris subdepressis, nitidulis, subregulariter punctato-striatis, in singulo elytro tribus seriebus dorsalibus spinarum multarum, longarum, gracilium, margine laterali spinis multis longis longitudine dorsalium, margine apicali brevioribus. Long. 4.5 mm.

To be placed next to *H. brunni* Ws. Brownish; spines darkened from their middle to apex. Head round; eyes small, oval, only half as long as the temples; vertex and clypeus smooth, lustreless, the last

finely carinate; neck not demarcated; antennae slender, only feebly thickened towards apex; joint 1 short, twice as long as broad; 2 only half as long as 1; 3 thin, scarcely three times as long as 2; 4 is equal to 5, each shorter than 3; 6 shorter than 5; 7 about as long as 6; 8, 9, and 10 equal, each somewhat longer than broad and shorter than 7; 11 longer by its apex than 10. Prothorax a little longer than broad; the apical margin convex and ciliated; the posterior angles acutely produced; the disk dull and shagreened, without depressions; lateral lobes large, with about 30 long, slender spines, in an arc along their lateral margins, the spines being as long as the disk is broad. The spines along hind margin of lobes in a single row, anteriorly in a double divergent row; the innermost spine on the anterior margin is curved and directed backwards and upwards. Scutellum fairly large, triangular, dully shagreened. Elytra elongate, broadened and rounded behind the shoulders, with 8 almost regular rows of punctures; with an interposed row of punctures between rows 5 and 6 posteriorly; depressions wanting; the straight intervals slightly carinate. On closer examination 4 rows of spines may be distinguished instead of 3 rows; interval 1 with 5 spines, of which the first is just before the middle and the second behind the middle; interval 2 with about 7 spines, which are already long from the base onwards; interval 4 with more than 10 spines; interval 6 with up to 20 and elytral margins with about 30 spines, with the spines crowded on interval 6 and along the lateral margin. All the elytral spines vary in length, the longest are as long as one elytron is broad; the spines on the posterior margin slightly shorter than those on the lateral margins.

Two specimens from Hottentot's Holland Mts., 4000 feet altitude, Caledon district (K. H. Barnard, January 1916).

31. *Platypria nigrospinosa* Fairm. (*mashonana* Pér.). One specimen each from Salisbury (1913, J. O'Neil); Salisbury: Arcturus (1916, Dr. Melle).

32. *Platypria natalensis* Gest. (Pér. in coll. of Ann. Mus. Civ. Gen., 3, 1 (xli), 1905, p. 516, fig.). Two specimens from Malvern; 1 specimen from Natal: Durban (Bell Marley). One specimen from Southern Rhodesia: Umtali (A. Bodong, 1902).

33. *Platypria nodifera* Spaeth, n. sp.

Reddish-yellow; the first two antennae joints, the prosternum, the pectoral region and its lateral parts, the abdomen with the exception of a broad outer border, two round spots next to each

other in the transverse furrow in front of the base of prothorax, the scutellum and all tubercular prominences and lateral spines on the elytra, black.

The contour rectangular, twice as long as broad, with almost parallel sides. Antennae strikingly short, about reaching the base of the prothorax; joint 2 globular; 3 a little more than twice as long, as long as 4 and 5 combined; 4 about a fourth longer than 5, this and the following not longer than thick; 9 twice as long as thick; 7-9 slightly thickened. Prothorax with 5 spines on each side, all, excepting the last, almost equally long, the larger ones with a slightly darkened apex; the disk transversely depressed posteriorly, almost dully, with the punctures distinct only on the dark spots. The humeral lobes of the elytra are scarcely broadened and carry 4 spines; then follows a short, shallow emargination; the middle lateral spine which follows is a little farther separated from both the neighbouring ones; after this follow 8 spines, so that altogether 13 spines are present on each side; all 13 are short, hardly more than half as long again as thick, the 2 last ones at the most slightly shorter; each elytron with 3 spines on the shoulders and about 14 tubercles on the disk, 4 each on the slightly carinate intervals 2 and 4, two on 6, and four very small ones on the 8th interval; of those on interval 2 the first one is a little before and the second one behind the middle, and the third and fourth on the declivity; those on interval 4 always stand obliquely behind those on interval 2; all these protuberances are small, low, and tubercular, the first two on the inner two intervals, and the first one on interval 3 a little larger; lateral expansions of elytra very narrow, and with the black thickened parts of the spines continued to its inner margin. $5 \times 3\frac{1}{2}$ mm.

British Museum; Transvaal: Pretoria (22/10/1921). Two types.

South African Museum; Transvaal: Mulder's Drift (5/11/1905). One specimen.

13. *Some Insects associated with the Plant Gnidia (Arthrosolen) laxa* Gilg.—By A. J. HESSE, B.Sc., Ph.D., F.E.S., Assistant, South African Museum, Cape Town.

(With Ten Text-figures.)

INTRODUCTION.

IN this paper an attempt is made to enumerate the different kinds of insects directly or indirectly dependent on *Gnidia laxa* during the autumn and summer months of September 1931 to May 1932.* The life-histories and stages in the life-cycle of some of those, found biologically or biocoenotically dependent, are here given for the first time. The study is necessarily limited in its scope, and is solely an attempt to show what interesting biological data could be obtained from the study of an ordinary plant like *Gnidia*. In its scope it does not purport to be an exhaustive list and neither does it attempt even to outline or solve all the intricate and complex relationships, biochemical, physiological, and chemo-physical problems bound up with any detailed biocoenotic or ecological study. It is more a study of the members of an interdependent group.

The study of insects and their host plants, apart from the economic point of view, has received but scant attention in South Africa. With the exception of a few common forms, the life-histories, larval stages, and pupae of but few are known. In the sphere of systematic entomology, which in itself demands all the attention of the student, very little time is available for the more interesting study of the habits, bionomics, ecology and life-histories of our rich indigenous fauna. If this, my attempt on a single plant, could awaken the interest of amateurs and students of insect life in this direction, its object would be more than achieved. As a matter of convenience the paper is divided into a general section dealing with the insects and the plant, and a descriptive part in which the larvae, pupae, and adults of new species are described for the first time.

* A season which was, however, more humid, with more frequent showers than either 1930 or 1933.—AUTHOR.

GENERAL.

The Plant, its Parasites and their Parasites.

All over the Western Province, particularly the Cape Peninsula, Stellenbosch and Somerset West, there thrives on more or less open country, in open and uncultivated patches or alongside roads, a somewhat straggling, sparse-leaved shrub. This plant *Gnidia* (*Arthrosolen*) *laxa* Gilg., a member of the *Thymeleaceae*, prefers gravelly soil and is more common on burnt patches, where it soon becomes abundant and luxuriant if not pressed out by its relative *Passerina vulgaris* or by the more vigorous "Renosterbos" (*Elytropappus rhinocerotis*), both of which also seem to flourish best in such areas. *Gnidia laxa* is found all the year round, but begins to flower in March and April. The normal shrub ranges in height from 1 foot to 2 feet, but vigorous plants may reach a height of 3 feet. When wandering through a patch of *Gnidia* the observer cannot help noticing that a large percentage of the plants possess peculiar thickened stems, which are often so common that one is inclined to attribute them to a normal condition. These stem thickenings assume various shapes, and no two stems are identical in these enlargements. They are either short subgall-like and some considerable distance away from the ground, more elongated, whip-like or snake-like and thickened from directly above the ground to the branches, *i.e.* uniformly thickened; or with enlargements extending even half-way up subsidiary branches and twigs; or, lastly, they are subnormal, only slightly thickened. On closer examination, it will be found that many of the older stems have scattered over them, here and there, small circular holes or perforations, the exit-apertures of some stem-loving insect. If any thickened stem be now plucked up and slit longitudinally, it will be found that the pith region of the stem is hollowed out by the galleries of numerous beetle larvae. In a single stem there are often, during September and October, numerous larvae, pupae, and recently emerged adult beetles. This little brownish-black beetle, known as *Hoplitopales lineatus* Boh. (text-fig. 1), passes the greater part of its life-history feeding and developing in the pith of *Gnidia laxa*. The beetle is a member of the great family *Curculionidae*, many of which are stem feeders.

The stem of the plant in an advanced stage of infection, when split longitudinally, shows numerous larvae, each larva (text-fig. 2) is isolated by itself in a central tunnel or gallery along the pith or axis of the stem, where it may be seen feeding either head downwards or upwards. In advanced stem-infection one larva may be separated

from another only by its collection of excrementa or frass-pellets, which in older stems practically occupy the entire pith-region. As the larva progresses the central gallery becomes gradually wider, but the maximum width is soon reached and the greater part of the tunnel is of the same width, only a very small part tapers to an indistinct point, showing the progress of the very young larva. As a certain number of moults takes place in the life of the larva, one may conclude that the moults in the latter part of its existence are not accompanied by a marked increase in size but are probably more metabolic in nature. Another explanation, which is more probable, is that after a certain stage the larva does not only eat its way forwards, but begins to enlarge its tunnel along the sides as well, never, however, exceeding a certain maximum and specific diameter.

During the prepupal stage it ceases to tunnel straight ahead, but bores to the periphery of the stem till it reaches the bark, and in this exit-gallery, just under the bark, it may pupate. This, however, does not always take place. Many larvae, after having completed the exit-gallery, turn backwards again towards the main tunnel, thus blocking up the exit with frass. When now they pupate in this exit-gallery or even in the main tunnel, the consequences are disastrous to the ensuing adult beetles, for it appears that many such adults are unable to find their way out through the frass plugging up the exits. The newly emerged adult is very pale-brown and presumably remains some time under the bark, before it perforates this to escape. The circular perforations outside on the stem are the escape-holes of the adults. The beetles emerging in the main tunnels cannot escape and many of these are thus found dead and firmly lodged in the mass of larval frass. This is especially the case in old, heavily infested stems.

The deaths of adults are, however, not always due to this fact, but many, especially in the case of heavily infested stems, may also be ascribed to the predatory nature of a small mite *Pediculoides ventricosus*, which is known to parasitise many other insects. This mite probably finds its way in through the escape-holes of successful beetles and, wriggling through the frass pellets, may reach a neighbouring tunnel containing a pupa or a freshly emerged beetle. The female mites become attached to the softer abdomen of the beetle and there develop into small spheres, the mouth-parts of which are firmly embedded in the tissues of the beetle. The entire abdomen of the beetle subsequently resembles a bunch of grapes, owing to the visible distended and spherical abdomens of numerous mites.

From the end of October to the end of June, and possibly the rest

of the winter months, no pupae or adults are found in the stem and the winter appears to be spent in the larval stage. The adults of this beetle have never been taken by me outside the stem of *Gnidia* and the larval and pupal periods are not exactly known, but the pupal period is probably short. The percentage of infested plants in any one patch is often considerable, and so striking is this in certain small areas that one is apt to mistake this stem-thickening as natural to the plant. Extensive areas are, however, not always very heavily infested. The most heavily infested patches which I have seen are those of plots within the municipal areas of Somerset West, which have been burnt and lain fallow for years. Plants bordering foot-paths and alongside gravelly roads often show a marked infestation and striking stem-enlargements. The powers of flight of the adult beetles are probably limited and the emergence of any considerable number in any one isolated patch will result in a very heavy infection.

It is difficult to state in what way infection disturbs the natural luxuriance and growth of the plants. By nature the shrub seems to be a straggler, is usually sparse-leaved and does not grow to any appreciable height. Infested plants are, however, as a rule, more vigorous than uninfested ones. It is possible that, as in the case of animal metabolism, diseased condition is often marked by an increased catabolic activity. There is no doubt that the stimulus applied by the larvae of this beetle is conducive to very vigorous growth on the part of *Gnidia*. The stem-thickenings produced belong to what Kuster termed the "*Histoid*" galls, namely, galls formed as a result of tissue malformations in contrast to "*Organoid*" galls due to organ abnormalities such as flowers, leaves, etc. He further subdivided the histoid formations into "*hyperplasmatic*" and "*hypertrophic*" galls. The former differs from the latter in that abnormal division and proliferation of tissue cells and not abnormal enlargement of individual cells take place. It is under the kataplastic type of the hyperplasmatic galls, where tissue differentiation resembles normal tissue, that these stem-thickenings fall. This development of stem tissue is probably attributable to the same cause that underlies gall formations in general, and in this case may also be due to the cumulative effect of a series of different infections. Tissue proliferation is due to the physiological activities of insect larvae, which may be chemical and enzymatic, physical or traumatic in reaction. The true causative agent of all gall formation has, however, never been isolated, and it is a problem which demands elucidation at the hands of experimental biology. Traumatic reaction and tissue injury in the case of other

plants have, however, been demonstrated as causative agents in extreme catabolic activity. The injury caused by the feeding larvae of *Hoplitopales* may be responsible for the vigorous growth and marked stem-enlargements. Bottomley's suggestion that nucleic acid derivatives are responsible for the liberation of what is termed "*auximones*" or promoters of growth in the plant may have some significance also, where tissue destruction may affect the growth, even remotely from the locus of activity, by chemical means.

While examining the frass in the empty and abandoned galleries in dead and dry stems, the remains of imprisoned parasitic Hymenoptera belonging to the genus *Eurytoma* were also found. It is difficult to state whether this Chalcid frequents the empty galleries or whether it is actually a parasite on the beetle larvae. The fact that the remains were found in the frass points to the conclusion that this *Eurytoma* is in all probability parasitic on *Hoplitopales lineatus*.

During March a large percentage of the shrubs are also found to be infested with still another beetle larva. These larvae (text-fig. 4) belong to *Sphenoptera cupreosplendens*, a member of the *Buprestidae*. In this case also, the percentage of infested plants is very great, and, moreover, no plant infected with the Buprestid was found that was not also infected with the Curculionid. All stages of larvae are found during March and many pupae at the end of March and during April, the adult beetles emerging during April. The larvae of the Buprestid do not cause stem-thickenings and neither are they found in or near the pith region. Very young stages are frequently found boring just under the bark or in the woody tissue just under the bark, comparatively high up, about 3-6 inches above the ground. They are geotropic, eating their way downwards; the more advanced stages being found at the base of the stem and in the main roots. Throughout its course the larva remains strictly superficial, never penetrating to the pith regions of either stem or root. The galleries are flattened in conformity with the dorso-ventral compression of the larvae and are never straight throughout their length. Above the surface of the ground in the stem the galleries are very wavy, extending to one side, then to the other of the stem, forming sharp U-shaped turns. In the main root the turns are less sharp, the gallery being moderately wavy.

From the position and nature of the tunnels, as a result of the examination of a very large number of stems, the following procedure on the part of the beetle probably takes place:—

The adult beetle lays its eggs somewhere in or on the stem, about

3-6 inches above the ground. The ensuing minute larva bores through the bark or begins to tunnel just under it. At first the tunnels are very fine and narrow, becoming broader and more distinct and also more wavy as the larva grows. The method of feeding is confined to an arc in front of the enlarged prothorax and in which the head is moved from one side to the other. When the base of the stem is reached, the larva tunnels down the large thick or main root or, less frequently, down another thinner root. By this time it has become considerably larger, making a fairly broad flattened tunnel. Near the apex or thin part of the root it turns back, tunnelling upwards again on the other side of the root, more or less parallel to its downward course. When it arrives at the junction of the stem and roots, where the stem is often slightly thicker, more knob-like, it reaches the end of its larval and feeding activity. The prepupal larva slightly widens the terminus and here changes into a pupa. The entire tunnel is plugged up with frass behind the feeding larva.

Only two or three larvae in a stem eventually become adults, the rest, not finding sufficient food material in the root-system, die or pupate in the stem above the ground, from where they do not seem to be able to get out. Fully formed adult Buprestids have been found dead in such positions. It thus appears that the final stage must come to rest at the base of the stem. The usual number of beetles in a single plant is two, one on each side between the base of the stem and roots, just under or at the level of the ground. Dead and dry stems have, however, been found with three beetles in them. Should the plant die, even after the larval existence, the pupae also succumb. Many dead or dying plants, during April, had dried and shrivelled-up pupae in them. No matter how carefully a stem is plucked up, the pupae do not seem to develop into adults under artificial conditions. There seem to be unknown chemical or physical factors in control in nature, which are disturbed or absent under laboratory conditions. These conditions, among others, demand a growing plant and certain states of temperature, pressure, and humidity. The fact that plants not infested with the Curculionid have not been found attacked by Buprestids, seem to point to the conclusion that the adult Buprestids only deposit their eggs on those plants with stem-thickenings, the physiological or catabolical conditions of which have been altered and are conducive to vigorous growth.

Dependent on the existence of the Buprestid larvae there is an interesting Braconid parasite. This small Braconid is new to entomology and is described below as *Hormiopterus brachypterus* n. sp.

(text-fig. 5). This interesting parasite is unique in this genus in having short rudimentary and vestigial wings, entirely useless for purposes of flight. Six females and two males of this Braconid have been hatched from a single prepupal or mature Buprestid larvae. It is apparent that the Braconid larvae pupate after the destruction of the larval tissues. They construct carton-like or parchment-like, woolly cocoons on the site of the consumed larva; leaving only the chitinous mouth-parts as a tell-tale of their activities. How, where, and when the adult Braconid deposits its eggs in the larva is a problem still unsolved. The fact that the adult Braconid is practically apterous and is provided with a comparatively long ovipositor points to the conclusion that most of its adult life is probably spent in crawling about the neighbourhood of the stems and root bases of the plant.

The ever-recurring problem, of how the parasite knows that a plant is infested with larvae of its host or just where under the bark the victim is situated, is still unsolved and one of nature's mysteries. The larvae of *Sphenoptera cupreosplendens* never come to light, but are confined throughout their life in darkness under an intact layer of bark. The Braconid has to deposit its eggs in the living larvae, and this it has to do by pushing its sharp ovipositor through the bark and into a larva just underneath. It is the locating of the larva under an intact bark that is a mystery. The matter is not one of pure chance, for the probability of an inserted ovipositor striking home in any stem is very small indeed. There must, therefore, be other unknown factors or stimuli, which control oviposition and render the probability much greater.

The pupae and immature beetles in their resting sites are subjected to still another danger, namely, that of being also attacked by the mites *Pediculoides ventricosus*. Not only this mite, but also a species of *Tyroglyphus*, attacks and destroys the pupae by feeding on their tissues.

During April many plants are rendered leafless through the activities of a caterpillar, which feeds on the leaves of *Gnidia*. This caterpillar is green, with a lateral reddish band along the coxal parts of its legs and prolegs, with a broad yellowish band along the side just above the red band and two narrow yellowish lines on its back. It becomes full grown when it is about 18 to 20 mm. long. The caterpillar is that of a Pyralid moth *Phlyctaenodes plumbatalis* Zell., a quite common species in the Western Province. The larvae have the habit of spinning threads all over the twigs as they are feeding. These threads

often connect up or join together clusters of leaves or even adjacent twigs. A certain amount of procryptic coloration, a harmonisation with the colour scheme of the background is shown. The fine twigs and some leaves are reddish to reddish-brown like the head and lateral band on the caterpillar. They also cling very closely to the twigs and their presence can often be surmised only from the presence of the silken threads.

When the larva is full grown, it becomes paler green in colour and is now ready for pupation. It now drops to the ground and enters the soil where it spins a silken cocoon, enclosing grains of sand and particles of earth. The period of pupation occupies 19 to 20 days, when the adult moth emerges. There are usually from two to four caterpillars on any one plant and these may cause considerable damage by defoliating entire branches. As a rule the caterpillars are more frequently found feeding towards the topmost part of the plants, the lower branches being still green with leaves.

Perhaps the most interesting member in this study of interdependence is a new species of a Tachinid fly, which I have described below as *Sturmia inimica* n. sp., the larvae of which are parasitic in the bodies of the caterpillars of this Pyralid *P. plumbatalis*. During April the adult female flies may be seen sitting very still and expectantly either near the head-end or clasper-end of a caterpillar. So intent are they in watching the caterpillar that these flies, normally very difficult to catch, may practically be touched with the hand. This is the time when the fly is about to deposit its eggs on the caterpillar. The period of quiescence is probably the period of preparation for oviposition. No matter how long such flies were watched, I have never been able to observe the actual act of egg-laying; disturbances in the environment, such as my own presence, a gust of wind, etc., have always frightened them away.

In the case of this Tachinid the eggs are laid outside on the cuticle of the caterpillar and usually above on the dorsum or on the sides above. The usual number of eggs laid on a single caterpillar is four, sometimes three, but of the few caterpillars found with eggs on them, no one had less than three. As a rule three eggs are laid on the pro- and meso-notum just behind the head and one at the posterior end just above the claspers, or along the side of the body opposite one of the prolegs. The three anterior ones are situated in a triangle, one on the pronotum behind the head on the left side, one a little more posteriorly on the right side nearer the base of the pronotum, and the third more or less medially on the anterior end of the mesonotum.

In one case the caterpillar had two on the pronotum and one on the side of the body. Whether all these eggs are laid by a single fly has not been observed, but the conclusion points to the fact that they are the eggs of a single female on any one caterpillar.

The eggs are very small (about $\frac{1}{2}$ mm. long) for such a comparatively large fly. They are oval, creamy-white, convex on one side and flattened on the other. They are glued on by means of some viscid secretion on the flattened sides and are very firmly lodged; neither alcohol nor formalin dissolves this substance. Caterpillars with attached eggs are not very common, and when the caterpillars themselves are not very easily seen or common, the difficulty of finding them is increased. Owing to the habit of the caterpillar of suddenly dropping in amongst the foliage on any prolonged disturbance, the fly must be fairly quick in depositing her eggs at a time. The presence of the eggs on the back of the caterpillar does not seem to interfere with its usual activity. It proceeds as usual, feeding peacefully, while burdened with these symbols of its own individual destruction and death. From the human ethical point of view there is something exceedingly repulsive in this type of destructive parasitism, where the lurking parasite devours its victim by degrees, not even granting it the slightest opportunity of fulfilling its own destination, yet allowing it, within limits, to obey and pursue its own specific urge until its hour is at hand.

The ensuing minute larva bores through the egg-shell on the glued-on side nearer one pole. It penetrates the cuticle of the caterpillar and apparently remains attached to this entrance for some time by its posterior end, thus keeping a communication with the empty egg-shell and the outside. It may leave this position under the egg-shell after a certain time, migrating elsewhere, where it perforates the cuticle again, making a new attachment and communication with the exterior. These loci of attachment are seen on the exterior of the caterpillar as dark-brown or blackish, more or less oval rings. In all the caterpillars which have been examined, there was no indication of a connection either with the tracheal system or the spiracles. Neither is the position of the parasite confined to any specific part. The larvae may be attached in the prothoracic region or the abdominal region; they may be on the side of the body opposite the prolegs or other abdominal segments or they may be found in the prothoracic region near the head, either attached dorsally, laterally or even ventrally between the legs.

The attached parasite projects into the body cavity, straight at

first during the very young stages, but when they are about 1 mm. long they acquire a distinct kink in the posterior quarter of the body, thus more or less lying close to the body-wall of the caterpillar. This curvature or kink may, however, be a result of the internal pressure of the organs and distended gut of the host; the parasite thus adapting itself to occupy the minimum amount of space without causing unnecessary inconvenience to the host. The rapid growth of the larva must eventually cause organ-displacement in the caterpillar. Only one larva is destined to pupate and reach the adult stage, the others probably succumb sooner or later. It is probable that the larva which hatches first is the one to monopolise the host in the end.

One caterpillar, with five eggs attached to it, went into the soil and completed its silken cocoon. Four days later, on the cocoon being opened, the caterpillar was still unpupated and very much alive. So much so that within an hour it had closed up the incision again. Yet four days afterwards on being opened again there was a complete fly puparium and only the remains of the caterpillar-cuticle in the cocoon-case. In another case, with four Tachinid eggs attached, dissection revealed four parasites inside, the oldest being about 1 mm. long. This caterpillar did not spin a cocoon. It merely dropped to the ground, lying inert for hours, apparently dead and with only a very feeble response. It was obviously incapable of spinning a cocoon. In all probability the most advanced parasite, in this case, would eventually have destroyed all the tissues of the host to pupate in the soil as is usual in very many other *Tachinidae*, and not in the empty cocoon. It would appear in the case of this Tachinid that the larvae either pupate in the empty cocoon-cases after the destruction of the caterpillar, or that they render the caterpillar incapable of spinning by destroying it vitally before cocoon formation, in which case they merely pupate in the soil as is the case of some Tachinids like *Carcellia*. The problem, of whether pupation takes place either in the empty cocoon-case or in the soil in the life-cycle of one and the same species, or whether either the one or the other is specifically or generically confined to certain Tachinids, needs experimental elucidation. In this case it certainly appears, according to limited observations and without elaborate experimental corroboration, that ultimate pupation depends upon the period of parasitism of the caterpillar, or at what period of its life it became parasitised. If an adult fly were to deposit its eggs on a caterpillar just emerged from the last larval moult, the ensuing fly larva would have a comparatively long period within which to develop to an advanced stage and thus

preclude cocoon-formation on the part of the host. On the other hand, should the eggs be deposited within a day or so prior to cocoon-formation, the caterpillar would still be vital and active enough to proceed with its final act, in which case the parasite would have to pupate in the cocoon. It must, however, be borne in mind that we are as yet totally ignorant of the stimuli or factors relevant to the existence of caterpillar-hosts, which are able to control and elicit egg-laying responses on the part of Tachinids. Neither do we know the physiological relationships between the host and parasite, which govern incubation and the period of emergence of larvae from attached eggs.

It is, however, certain, at least in this case, that some eggs on the same caterpillar hatch before others and that certain larvae inside are larger than others. Even here, however, it is impossible to state whether certain positions, even within the caterpillar, are not more favourable physiologically than others and that larvae progress more favourably when situated there. In the caterpillars mentioned above, the most active parasite was attached on the side somewhere in the region of the prolegs at about the middle of the body and not under an egg-shell. They were specimens that had migrated there.

Judging from the undisturbed condition of the body-cavity of the dissected caterpillar, it appears that these larvae, up to 1 mm. long, probably subsist only on blood-plasma and body fluids, which they obtain either through a minute and indistinct oral opening, or through "physiological filtration" and not through tissue destruction. As in the case of the majority of Tachinids, the larva probably becomes free in the body cavity to devour the fat-body and vital organs after the third instar. The empty caterpillar skin, in the case of the specimen that pupated in the cocoon, was certainly the only thing that remained over. It is also noteworthy that no frass was found in the cocoon or skin. In the case of parasites still attached, excretions, if any, will most likely be voided outside, or there may be a possibility that the darkened socket-like rim in which the posterior end of the larva is lodged, and which really corresponds to a sheath, is composed in part of excretory products and in part of the cuticle of the caterpillar. This socket-like ring has no anatomical connection with the parasite, the posterior end of the body being merely lodged or retained in position by the last circlet of segmental spines, or by the dorsal and ventral clusters of hooks mentioned in the descriptive part.

The period of incubation, the periods of the instars, and the period of pupation are at present unknown. The ensuing larva, prior to pupation, ruptures the cuticle of the host on the side. The puparium,

formed by the hardening of the last larval instar, is immobile, reddish-brown, slightly darkened at the ends, more narrowed apically, is indistinctly segmented and with the posterior spiracles of the larva still visible as three bosses on each side, whereas the anterior ones are represented as a small process on each side near the cephalic end. I am unable to state whether the larvae of *Sturmia inimica* are specifically restricted to this one host or whether other species of *Phlyctaenodes* in the Cape may not also be parasitised by this fly.

Also attacking this plant externally there are at least two kinds of Coccids, both of which are, however, uncommon. One is a member of the soft-scaled group belonging to the genus *Ceroplastes*, the females of which secrete a thick, white waxy covering. One of these specimens was parasitised by four maggots of some Acalypterate fly, probably an Agromyzid, the adults of which I have not obtained. The other Coccid is much rarer and is a member of the true-scaled group belonging to the genus *Tachardia*.

Chance Visitors and Random Feeders, Defenders of the Plant, etc.

At least five different kinds of insects were also found feeding on this plant. These, namely, three kinds of *Curculionidae*, *Hypsomus bevinsi* Mshl., *Eremnus setifer* Boh., and *Lixus alboguttatus* Boh., one Chrysomelid, *Polystica fasciata* de Geer., and one Pentatomid bug, *Steleocoris comma* Thb., although found feeding on it, are probably not restricted to it, for they have been obtained from other plants as well. The bug has, however, a better claim to being considered as a constant feeder, owing to the presence of nymphal stages on the same shrub during April. The adults of the Buprestid borers have also been taken on the leaves during April.

Of the predaceous fauna, sometimes found among the foliage and which may be considered as defenders of it, there are two or three species of Attid spiders, which construct small silky nests among the leaves, and at least one juvenile of a species of preying Mantid (*Miomantis* sp.) common during March and April. At least one species of non-parasitic mite, a representative of the *Oribatidae*, is often found crawling about on the twigs and leaves.

Non-paying Tenants.

The empty galleries and tunnels in the dead and dried stems also harbour certain insects and spiders. A small immature Attid spider

habitually frequents the exit galleries of the Curculionid, where it lines the sides with silk. The most important inhabitant of these empty galleries and tunnels is, however, a new species of Thrips, which I have described in the systematic part as *Dicaiothrips gnidicolus* n. sp. (text-fig. 9). This Thrips is also remarkable for its rudimentary wings, which are useless for purposes of flight, and which have become functionless as a result of its cryptic habits. The entire life-history is passed inside the empty galleries and among the frass. An adult male and female and a brood of young ones are usually found in one gallery; the adjoining one being often occupied by another couple. The adults, as well as the young stages, have never been observed outside on the plant, and presumably they never leave the tunnels except to occupy adjoining ones.

The female lays a batch of eggs, about 14 to 16, on the sides of a tunnel, all with one pole pointing upwards. The eggs are glued on and are not contiguous, but separated from one another. Both sexes seem to keep guard over the eggs, somewhat after the manner of earwigs, and are loath to abandon them even when exposed to daylight. During September to October, and again in April, all stages, eggs, larvae, pupae (text-fig. 10), and adults, are found in the stems; sometimes a solitary couple and a batch of eggs in one gallery and a couple together with larvae and pupae in another. The larvae and pupae also receive the solicitude of the adult couple as in the case of the eggs. The larvae (text-fig. 10, *b* and *c*) in all stages are of a beautiful ruby-red, with dark antennae, legs, and posterior tube, and, like the adults, are negatively phototropic, trying to avoid the light by creeping and crawling away to hide in the frass.

Both adults and larvae have a peculiar gait, giving one the impression of being mechanical. Their progress is characteristic; stiff, erratic, as if on stilts, the larvae often running along and then stopping like some water-birds. The adult, on the other hand, is more deliberate in its movements, suggesting those of a scorpion; often, like a scorpion, taking up a threatening attitude with the front legs extended and the slender posterior tube slightly raised like the tail of a scorpion. The pupa is also capable of rapid progress when disturbed. There is no doubt that this Thrips does not frequent flowers, but, like many members of this group, probably feeds on vegetable or organic debris and in this case probably on fungi or micro-organisms thriving in the frass. This species may thus not be confined to the galleries in *Gnidia*, and may also inhabit crevices or other dark environments.

It is, however, different from other members of the genus which have been met with in such positions.

The interdependence of living organisms in connection with the dry stems and the empty tunnels of the beetles is further illustrated by the use that a small bee makes of these galleries. A species of *Ceratina*, a member of the carpenter-bees, uses these tunnels for building its nest. The bee in this case, contrary to the usual procedure of the carpenter-bees, does very little carpentering, confining most of its activities in this direction to trimming or patching up. The galleries already in existence are used, and in the case of two or three tunnels being practically continuous or merely separated by masses of frass, the bee removes the frass, thus making a long continuous tunnel. In some cases, however, even this is not done, the tunnels and exit-galleries being used irregularly as they are. The bee stores the tunnels with food packets composed of bee-bread, which in the former case are arranged in tiers, each packet being sealed off after an egg has been laid. More often, however, an exit-gallery is stored with a packet and the exit-hole is plugged up after an egg has been laid, each exit-gallery thus lodging a single larva or pupa. In the latter case the cells are of course naturally partitioned off by the plugs of beetle frass. The arrangement is thus primitive to a certain extent, depending solely on the nature and position of pre-existing galleries. The adult bees probably emerge at the end of September or in October, for during this period advanced pupae and empty pupal cases are found. There is another brood again in April, which is, however, represented by larvae only. The adult bee has never been taken outside, and neither was it possible to hatch it from the pupae.

Death of the Plant and its Causes.

A growing plant that is so heavily infested with the larvae of two kinds of beetles, which destroy its tissues internally, by caterpillars which often defoliate it externally, by Coccids which sap its strength, and by other insects which feed at random on its tissues and juices, is bound to succumb sooner or later, notwithstanding its diseased catabolic vigour. Probably all the factors contribute to its death, but judging from wilting and dying plants in the veld, the conclusion seems to point to the fact that the activity of *Hoplitopales* alone does not primarily cause death. The two deciding factors are the larvae of the Buprestid in the roots and the defoliation brought about by

the Pyralid caterpillars. Wilting plants, when plucked up, show that the tissues under the bark of the thicker roots are practically one mass of frass, and that often three Buprestid pupae are lodged in the base of the stem. There seems to be no doubt that the Buprestid is majorily responsible for the death of flourishing plants, owing to its position in the plant, where it is injurious, causing the destruction of sap-conducting vessels.

SUMMARY.

In summarising the data obtained for a period of six months, it is found that the existence of a single plant is thus biologically bound up with the life, habits, and life-histories of no less than 21 species, belonging to 7 orders of insects, three different kinds of mites, and two or three kinds of Attid spiders. These are as follows:—

- (1) *COLEOPTERA* : Fam. *Curculionidae*, *Eremnus setifer* Boh., *Hypsomus bevinisi* Mshl., and *Lixus alboguttatus* Boh. Found feeding externally on the leaves and twigs. Fam. *Curculionidae*, *Hoplitopales lineatus* Boh. The larvae of which bore in the stem, feeding on the tissues and causing stem-thickenings, and finally pupating and emerging as adults in the stem.

Fam. *Buprestidae*, *Sphenoptera cupreosplendens* Cast. and Gor. The larvae of which tunnel and feed just under the bark at the base of the stem and in the roots, pupating at the base of the stem and roots.

Fam. *Chrysomelidae*, *Polystica fasciata* de Geer. An adult of which was taken outside on the plant.

- (2) *LEPIDOPTERA* : Fam. *Pyralidae*, *Phlyctenodes plumbatalis* Zell. The caterpillars of which feed on the leaves and pupate in the ground.

- (3) *HYMENOPTERA* : Fam. *Eurytomidae*, *Eurytoma* sp. ign. Remains of which have been found in the frass and in the galleries of *Hoplitopales*, and which is most likely a parasite on the larva.

Fam. *Braconidae*, *Hormiopterus brachypterus* n.sp. The adults of which were bred from a prepupal larva of the Buprestid, on which the Braconid larvae feed.

Fam. *Apidae*, *Ceratina* sp. ign. The larvae and pupae of which have been found in nests constructed in the empty galleries in dry stems.

- (4) *HEMIPTERA* : Fam. *Coccidae*, *Ceroplastes* sp. ign. The female of which secretes a white, waxy scale, found on the twigs.

Fam. *Coccidae*, *Tachardia* sp. ign. Found as brownish, irregular scales on the stems and main branches.

Fam. *Pentatomidae*, *Steleocoris comma* Thb. Adults and nymphs of which have been found feeding on the leaves and twigs.

- (5) *DIPTERA* : Fam. *Tachinidae*, *Sturmia inimica* n. sp. The adults of which lay their eggs outside on the anterior or posterior end of the caterpillars of *P. plumbatalis* Zell., on which the ensuing larvae feed, finally killing the caterpillars and pupating in the caterpillar-cocoon or in the ground.

An Acalypterate fly, probably an Agromyzid, the larvae of which parasitise the Coccid *Ceroplastes*.

- (6) *THYSANOPTERA* : Fam. *Idolothripidae*, *Dicaiothrips gnidiicolus* n. sp.
The adults of which inhabit the empty galleries in dry stems in couples, depositing their eggs and rearing their larvae and pupae in them.
- (7) *ORTHOPTERA* : Fam. *Mantidae*, *Miomantis* sp. ign. The nymphs of which are commonly found lurking among the twigs and leaves.
- (8) *ARACHNIDA* : Sup. Fam. *Sarcoptoidea*. Fam. 1. *Tarsoctenemidae*, *Pediculoides ventricosus*. Nymphs and adults of which are predaceous or parasitic on pupae and adults of the Curculionid and pupae of the Buprestid.
Fam. 2. *Tyroglyphidae*, *Tyroglyphus* sp. ign. Nymphs and adults of which attack the pupae of the Buprestid.
Fam. *Oribatidae*. Free living mites, representatives of which crawl about on the leaves and twigs.
Araneae : Fam. *Attidae*. Two or three adult spiders of which lurk among the foliage, even spinning or constructing silken nests among clusters of leaves. At least one species of juvenile uses the empty galleries as a refuge, lining it with silk.

SYSTEMATIC.

All the figures are freehand drawings made by the author and are not necessarily to scale, but more or less in proportion.

Explanations of the lettering to the text-figures are:

A.C. Anal cell.	M. Mandible.
An. Antenna.	Max. Maxilla.
A.S. Anterior spiracle.	Med.Sc. Medial sclerite.
A.Se. Abdominal setae.	M.C. Medial cell.
A.T. Anal tubercle.	M.Sc. Mandibular sclerite.
A.V. Anal vein.	Oc. Ocellus.
Cl. Clypeus.	O.S. Ocellar spot.
Co.V. Costal vein.	P. Papilla.
Cr.V. Cross vein.	Pa. Palp.
C.Se. Cephalic seta.	Ph.Sc. Pharyngeal sclerite.
Cu.C. Cubital cell.	P.P. Pronotal plate.
Cu.V. Cubital vein.	P.S. Pigment spot.
E. Eye.	R. Rostrum.
El. Elytron.	R.Se. Rostral setae.
F. Fold.	S. Spiracle.
Fe. Femur.	Se. Posterior long setae.
Ga. Galea.	Sp. Spined or shagreened area.
I.Sc. Intermediate sclerite.	T.L. Thoracic legs.
L. Labrum.	Tr. Trochanter.
L.L. Lateral lobes.	T.S. Thoracic segments.
La. Labium.	T.Se. Thoracic setae.
Le. Leg.	W. Wing.
L.V. Longitudinal vein.	

ORDER COLEOPTERA.

Family CURCULIONIDAE.

Subfamily MENEMACHINAE.

Genus *Hoplitopales* Schoen.

H. lineatus Boh. (text-figs. 1, 2, and 3).

LARVA.—White, with pale straw-coloured or yellowish head, the mandibles brownish. Shape eruciform, posteriorly slightly thickened opposite eighth segment, with no legs on thoracic region, only three pairs of rounded tubercle-like elevations being present, the anterior ones being closer together, all with a few slender, hair-like setae.

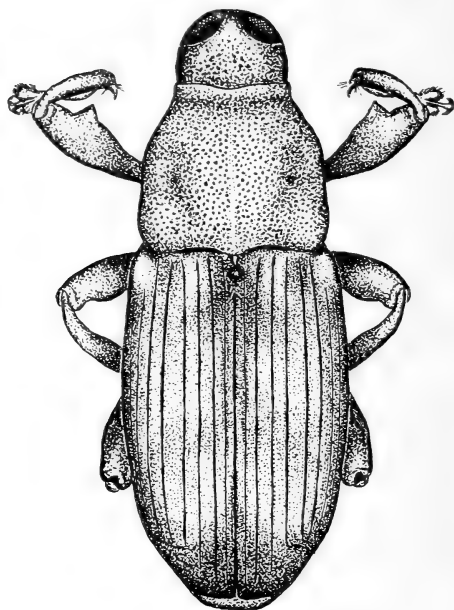
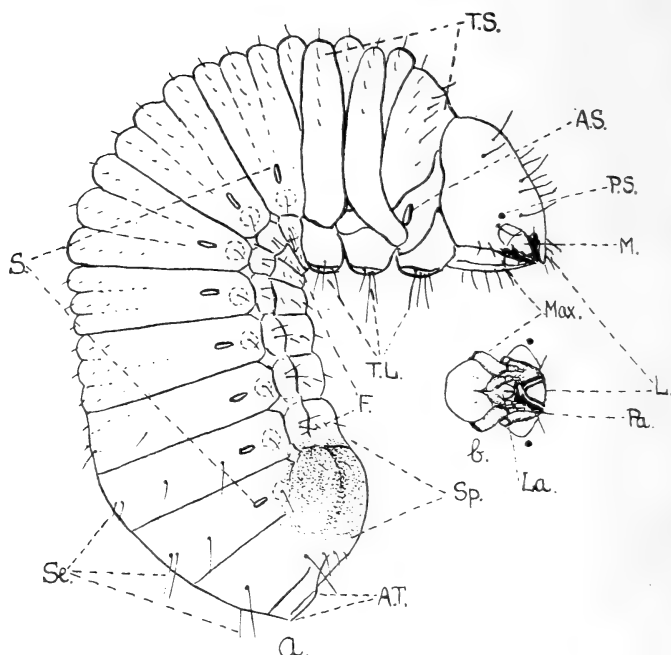
Head chitinous, exserted, with a black pigment spot on each side near the base of mandibles, with the cephalic setae as shown in text-fig. 2 (*a* and *b*); mandibles chitinous, with two teeth apically; antennae absent; maxillary palps two-jointed; labial palps two-jointed; with an indication of a central, depressed line behind labrum, and there more depressed than posteriorly.

Thorax transversely wrinkled, with the three divisions corresponding to the thoracic tubercles not very distinct; the single thoracic spiracle on the first segment chitinated, brownish (text-fig. 2, *a*).

Abdomen with the nine segments only distinctly visible on sternal regions, the tergites being transversely wrinkled, with the sternal region divided from the tergal part by a lateral fold (text-fig. 2, *F.*), becoming indistinct on segment 8, and being elevated, more or less boss-like or knob-like opposite each segment, each tubercle bearing a very fine hair-like seta; segments 1 to 8 each with a small spiracle on each side; tergites 1 to 4 dorsally more or less divided into three transverse wrinkles, each wrinkle with a transverse row of very minute setae; segments 7–9 each with a transverse row of widely separated and much longer hair-like setae (text-fig. 2, *a*, *Se.*); the ninth segment terminates in a tumid tubercle-like anal process (text-fig. 2, *a*, *A.T.*); sternites each with a transverse row of microscopic setae, with sternite 8 much broader and more dilated laterally than the others, less shiny, dull, roughened by a distinct and much coarser micro-sculpture, composed of microscopic spines or denticles (text-fig. 2, *a*, *Sp.*). Length about 6–8 mm.

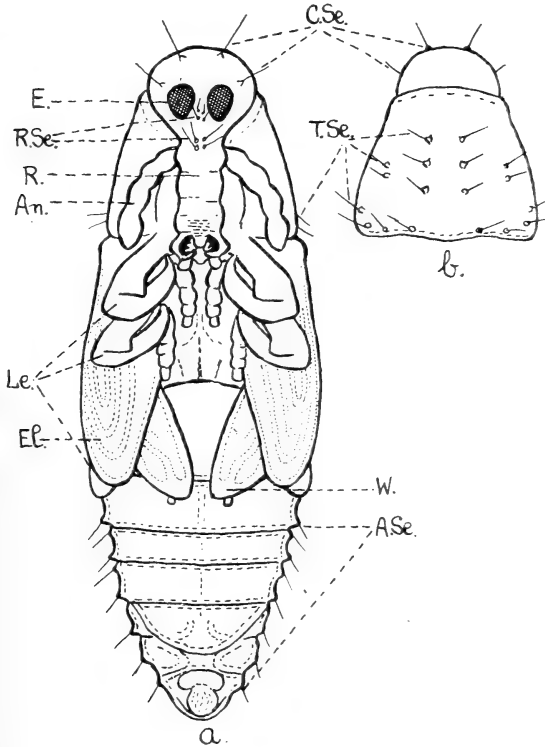
PUPA (text-fig. 3).—White; the eyes and mandibles dark-brownish to blackish. All the structures of the adult are already visible.

Head (text-fig. 3, *a*) with four longish setae, one on each side more

TEXT-FIG. 1.—*Hoplitopales lineatus* Boh.TEXT-FIG. 2.—Larva *Hoplitopales lineatus* Boh.

laterally just behind eyes, another one further back and nearer the mid-line on each side; mandibles with two teeth; rostrum with 2 or 3 long, fine hair-like setae on each side at base between the eyes, and further forwards just behind the antennal insertions there are 2 or 3 smaller setae on each side.

Pronotum with 3 long setae on each side discally above at about



TEXT-FIG. 3.—Pupa of *Hoplitopaless lineatus* Boh.

the middle, with another one on each side at base a little more lateral to the discal ones, with 1 or 2 setae discally and laterally on each side at about the middle, and 3 or 4 on each side intra-marginally along basal angles.

Abdomen sulcated dorsally, with more or less three longitudinal rows of setae on each side of the mid-line. Length about 5-6 mm.

Distribution: Somerset West, C.P. (coll. September, October, March, and April).

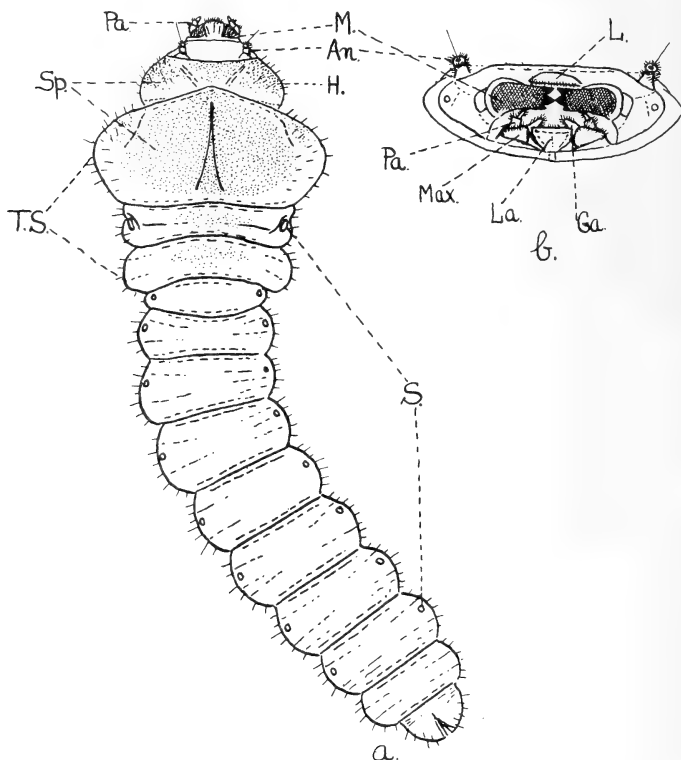
Family BUPRESTIDAE.

Subfamily SPHENOPTERINAE.

Genus *Sphenoptera* Sol.

S. cupreosplendens Cast. and Gor.

LARVA (text-fig. 4, *a* and *b*).—Body dorso-ventrally compressed, shagreened, covered with microscopic spines; white, in very young stages often with the internal parts shining through reddish (probably



TEXT-FIG. 4.—Larva of *Sphenoptera cupreosplendens*.

due to the reddish tissue of the root under the bark); the basal part of the mouth-parts above and the lower parts of mouth reddish-brown, the apical parts often being darker, more brownish; the mandibles blackish-brown to black; antennae brownish at base, pale yellowish-white at apex; labrum pale yellowish-white, except for the lateral parts which are more brownish in advanced larvae; labium pale

yellowish-white, the basal part whitish; maxillary palps translucent whitish, the lateral parts of joints 1 and 2 chitinous and brown; a central smooth impressed line on the pronotum, bifid before the middle, and a central impressed line on the sternum of the same segment chitinised and yellowish-brown, more brownish anteriorly; the spiracles chitinised and yellowish.

Head with the apical part of mouth parts above more or less subrugose in advanced larvae; eyes and ocelli absent; antennae rudimentary, represented laterally on each side of mouth-parts above as short two-jointed structures (text-fig. 4, *b*), the apical joint being small and subglobular, bearing one long fine seta and a crown of minute ones apically, with the basal joint smooth and setiferous apically only; labrum rotundately rounded apically, smooth above, slightly convex discally, with an indication of a central impressed line, apically with numerous short, yellowish setae; mandibles shining, bidentate apically and with a third much smaller tooth near apex on lower margin; maxillae with the palps two-jointed, the apical one slender and the basal one subglobular and with very short pale setae externally; no visible labial palps, but galeae (text-fig. 4, *b*, Ga.) visible on maxillae; labium rotundately rounded apically, with numerous short yellowish setae on apical part, discally slightly convex, with an indication of a central groove and an impressed furrow on each side, the surface feebly shagreened; mentum broad apically, its margin truncate, its base narrow and pedunculate; head broadest just before base, about twice as broad as long, the sides rounded, more rapidly narrowed apically, with the apical margin slightly emarginate medially, the upper surface more convex laterally, shagreened, more coarse and denser antero-laterally, where the spines are more distinct and longer, only a few scattered setae present.

Thorax with the pronotum the broadest part of the body, the sides much dilated and rounded or even subangularly rounded, broadest at about the middle, much dorso-ventrally compressed, with the apical margin arcuately rounded and produced over the base of head, with the dorsum more or less flattened above, the discal part opaque and shagreened, with a central impressed line, bifid from before middle, with the sides above slightly more convex and less opaquely shagreened and the isolated setae longer than those on head; prosternum also much flattened discally, opaquely shagreened discally, the anterior margin also arcuately rounded, the base straight, with the microsculpture finer than on head below, with a single central impressed line (these dorsal and ventral lines are in reality gristly or

chitinous rods sunk in the skin, constituting part of the internal skeleton or tentorium to which the powerful dorso-ventral and oblique muscles are attached); mesonotum much narrower than pronotum, slightly broader or as broad as head, the surface shagreened, but shining, with a large spiracle on each side, the disk above also with a more roughened area; metanotum as broad as mesonotum, without a spiracle.

Abdomen with 10 visible segments, the ninth being partially divided, with the segments in the young stages more drawn out, longer than broad, in the advanced stages more constricted, broader than long; segment 1 often slightly narrower and shorter than the others; the first eight segments with a small spiracle before the middle on each side; the entire abdomen finely shagreened, more or less transversely wrinkled in advanced stages and provided with fine hair-like setae above on the sides and below; segment 9 with the apical division more or less smooth, conical or mammillate, perpendicularly cleft in the apical half, the lips of this cleft being often tumid.

No legs or even tubercular processes present.

Length about 11–13 mm. (mature larvae).

Max. breadth of pronotum about $3\frac{1}{2}$ –4 mm.

The very young larvae from 6 mm. onwards are much more dorso-ventrally compressed and the abdominal segments are more drawn out and very extensile, capable of active worm-like movements.

PUPA resembles the adult beetle, with all the structures present. It is white, the eyes being slightly darkened, head with the eyes distinct; clypeal part distinct; the antennae are long and segmented; pronotum shaped as in the adult, smooth, but with two medial prominences on basal margin; elytra in process of development, but as yet narrow and lobate; wing rudiments as long as elytra; legs already present. The pupa is capable of slight movement.

Length about 10–11 mm.

Distribution: Somerset West, C.P. (coll. March and April).

ORDER HYMENOPTERA.

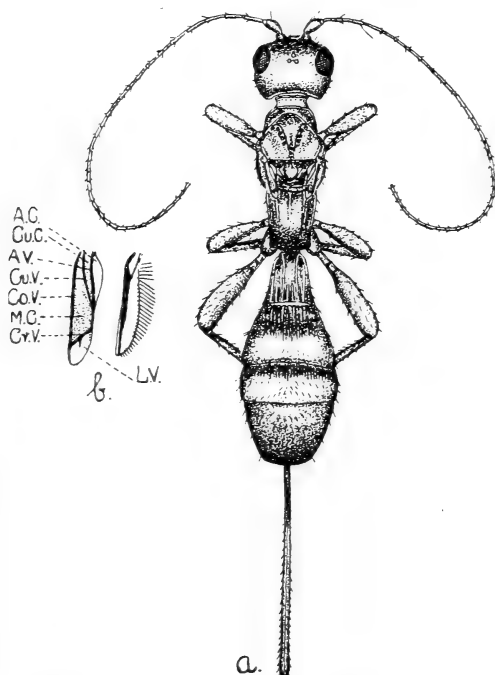
Family BRACONIDAE.

Genus *Hormiopterus* Giraud.

H. brachypterus n. sp. (text-fig. 5, *a* and *b*). 2 ♂♂, 6 ♀♀.

Body black, more or less shining; the ♀ with the circumoral region, mandibles (the apices excepted), a transverse arcuate band across disk

of fused third abdominal segment above, a longer and often broader transverse band at about middle of segment 4, the apical margins of 5 and 6, the ventral part of sternite 1 to a certain extent, the suture between the pro- and mesopleurae, the mesosternal region in part and the knees more or less shining through reddish to reddish-brown; the



TEXT-FIG. 5.—*Hormiopterus brachypterus* n. sp.

basal half of the antennae, the apical collar-region of the pronotum, the membranes between the femora and trochanters, the extreme apices of the tibiae and the apical parts of the tarsal joints 1 to 4 more or less dirty yellowish-brown; the tegmina with the veins and apical three-fourths of medial cell sepia-brown; the minute cubital cell, anal cell, and the apex hyaline; the hind wing hyaline, with the one vein sepia-brown; the short, subrecumbent hairs and setae on the body silvery-whitish; the ♂ is coloured like the ♀, but the allotype shows more reddish on the sternal regions and the apical margins of all the abdominal segments above more or less shine through reddish.

Head subglobular, seen from above, slightly broader than long, broadest across the eyes, the sides behind the eyes rounded and

narrowed to base, about as deep from above eyes to mouth as long, slightly broader across eyes than deep; vertex convexly continuous with sides and interocular part, with the integument more or less transversely rugulose and indistinctly reticulose; ocellar region in front being finer, more shagreened and the circumocular part finely shagreened; the lateral regions and cheeks below the eyes more uniformly and slightly more coarsely shagreened; frons plane or slightly depressed, finely rugulose, often more strigillose laterally; face somewhat more convex, medially below antennae, finely shagreened, finer circumorally; the fine hair on head short and scattered above and behind eyes, slightly longer and denser on face and malar space; eyes convex, small, oval, about as long as malar space, which is without a furrow; ocelli minute (much smaller than in *capensis* Brues), arranged in a triangle, raised only slightly above the surface, nearly three times as far from the eyes as from one another; antennae filiform, long, slender, with 32 to 35 joints (3 ♀♀ with 35 joints, 3 ♀♀ with 34 joints, 1 ♂ with 34 joints, and 1 ♂ with 32 joints), nearly as long as body, comparatively longer in ♂, with the first joint of scape elongate-oval, deeper than broad above, subequal to joint 1 of the flagellum along upper margin, comparatively shorter in the ♂, with one long seta and a few shorter ones below, with joint 1 of the flagellum the longest, longer in the ♂ and also subequal to joint 2, in the ♀ very slightly longer, with joints 3 to 10 shorter than 2, becoming very gradually and progressively shorter, with joint 11 to apex so gradually and progressively decreasing in length that sets of them appear subequal, the apical ones being about three times as long as thick; clypeus with the apical margin elevated and semicircularly emarginate (as in other *Cyclostomini*), with the semicircular suture and depression between it and the face distinct, with about 8 long, erect, hair-like bristles along the margin above, of which the outer ones are the longest; mandibles with the apices crossing; maxillary palps 5-jointed, comparatively long, with the setae on the lower margin of joints 2 to 4 straight and at right angles to the joints; labial palps shorter, 4-jointed.

Thorax with the pronotum just visible from above as a collar-region, with the apical part of pronotum translucent, projecting plate-like into occipital region, its anterior margin subtruncate, carinate, and slightly reflected upwards, its sides sinuous, slightly constricted, then widened and continuous with the broadly rounded propleural sides, with a transverse carinate ridge just behind middle between apex and anterior mesonotal margin, straight above and oblique on propleurae,

parallel to propleural margin; propleurae shining, with curved parallel rugae on lower part and a series of irregular, short, and oblique rugae in upper corner; prosternum depressed centrally, more or less rugulose antero-laterally, shining and subshagreened discally on each side; mesonotum shining, shagreened, with the parapsidal furrows distinct, composed of shallow, subfoveate punctures, more depressed anteriorly, with the inner edges sharply marked as the middle lobe is raised anteriorly above lateral ones, with a deep and distinct middle furrow posteriorly, composed of a row of foveate punctures and only indicated as a faint depressed line just before middle, with the posterior mesonotal margin straight and with an intramarginal depressed line extending laterally round the obtusangular postero-lateral angles, with a row of separated, backwardly directed, short hairs along the inner margins of parapsidal furrows and along sides posteriorly; scutellum with the discal part convexly conical, shining, slightly shagreened near base, subcarinate laterally, with the basal furrow arcuately depressed and composed of a row of irregular foveae; mesopleurae convex medially, with the upper anterior part shining, feebly shagreened, the middle part shining, feebly shagreened, with an oblique, somewhat arcuate foveated depression delimiting the upper anterior part, with a depressed row of large punctures intramarginally along posterior margin and another less distinct row along the lower carinate margin, with the short hairs scattered and sparse; wings abbreviated, very short, narrow, with the anterior ones (text-fig. 5, *b*) lamellate, about $\frac{1}{2}$ mm. long, the apex narrowed but rounded, broadest near base, with the combined costal, subcostal, radial, and medial veins extending as a single costal vein (Co.V.) to near apex, with a short cubital vein (Cu.V.) extending obliquely to join first anal vein (A.V.) thus delimiting a large medial cell (M.C.) and a minute cubital cell (Cu.C.), with the oblique cross vein (Cr.V.) near apex often giving off a vestigial or rudimentary longitudinal vein (L.V.); hind wings narrower and slightly shorter than the front ones, the apex subacute, with only a broadened costal vein along outer side, often not quite along the margin apically, with a minute cellule basally, the inner margin with a fringe of fine, delicate ciliary hairs; mesosternum with a central depression, shining, shagreened medially, more rugulose laterally, the anterior margin carinate; propodeum shining, more or less convex, shagreened basally above, but more rugulose towards summit of declivity and more or less transversely rugulose on declivity, with the sides carinate, more so basally on each side and with three carinate ridges (the middle one being the shortest) on dorsum in basal half,

with the declivity sloping, not steep; metapleurae shining, more or less shagreened discally and along upper anterior part, with irregular rugae along lower, posterior upper and posterior parts, with a punctate line next to mesopleurae, the lower margin with a tooth-like projection on each side anteriorly just behind middle coxae.

Abdomen convex above, about as long as head and thorax combined, slightly longer in the ♂, broader than the thorax, broadest across apex of segment 3 or 4; segment 1 about as long as or slightly shorter than propodeum along the side, narrow basally, then rapidly widened to spiracles, then gradually widened to apex, with the upper surface convex and (side view) slightly arched before middle, shining, shagreened, with 4 longitudinal carinate ridges above, the apical half with numerous parallel rugae or striae discally, with the sides beyond carina 4 on each side more or less perpendicular, shagreened and with a small spiracular prominence near base, the lower margin carinate; segments 2 and 3 fused together, with the suturiform articulation visible as a transverse line, more distinct laterally, and behind it a transverse depression just before the middle of the fused segments, with the combined segments about as long as or very slightly longer than 1, broadest at apex, nearly twice as broad as long in ♀, about as long as broad in the ♂, with the sides widened to apex, with the basal half longitudinally striate discally, the striae being slightly coarser and further apart, less regular at extreme base, with the discal or apical part of segment 3 more convex, shining, shagreened, the extreme apex being nearly smooth, with the sides in basal half subperpendicular, shagreened, a small spiracular prominence laterally near base, with the short, subrecumbent hairs arranged more or less in three transverse rows, the last row with an indentation medially, the postero-lateral regions more finely shagreened; segment 4 broadest just behind middle, broader in the ♀ than in ♂, shorter than 2 and 3 combined and shorter than 1, transversely depressed just before middle, with the basal part longitudinally striate, the apical half shagreened, more indistinctly along hind margins, with the short hairs also in three transverse rows as on segments 2 and 3, with the sides rounded and shagreened; segment 5 in the ♀ longer than 4, its hind margin semi-circularly rounded, with the integument shining, shagreened, more coarsely at base on dorsum, very nearly smooth along hind margin, with four more or less irregular transverse rows of backwardly directed and separated hairs; in the ♂, segment 5 is subequal to or slightly longer than 4; segments 6 and 7 visible in the ♂, the last small, in the ♀ they are hidden or telescoped under 5; venter more or less depressed,

concave, shining, shagreened, with the basal half subcarinately raised along midline of sternites 1 and 2 in the ♀ and beyond them in the ♂; sheath of ♀ ovipositor about 2 mm. long, about as long as abdomen, dorso-ventrally compressed, narrow, the apex very slightly broader than the base, straight, shining, shagreened, with numerous short, backwardly directed hairs; last sternite or genital segment in the ♂ with three short, longitudi-carinate ridges, separating slight depressions.

Legs shining, shagreened, with short, subrecumbent hairs, denser on the tibiae below and on the tarsi, with the posterior legs the longest; posterior coxae more developed, unarmed behind, but with a triangular prominence basally below (anterior surface below); femora with the hind ones more incrassate, comparatively more so in the ♂; tarsi with the pulvilli well developed, the posterior tarsi subequal in length to the tibiae.

Length about $3\frac{1}{2}$ –4 mm.

Breadth about $\frac{3}{4}$ –1 mm.

Anterior wings about $\frac{1}{2}$ mm. long.

The entire brood (1 ♂ allotype, 1 ♂ paratype, 1 ♀ holotype, 5 ♀♀ paratypes) hatched from a single prepupal larva of *Sphenoptera cupreosplendens* Cast. and Gor., which was found resting in the base of root and stem of *Gnidia laxa* Gilg. Collected at Somerset West, C.P., during March 1932 and hatched in April 1932.

The cocoon-cases of *Hormiopterus brachypterus* n. sp. are elongate, more or less narrowed and attenuated to an acute point at one pole. They are composed of a delicate, translucent carton-like or parchment-like silky or woolly material. From the evidence of the cocoons it appears that the mature larvae of this Braconid pupates after the entire destruction of the Buprestid larva, occupying only the site of the Buprestid and leaving only the prothoracic tentorium and chitinous mouth parts of the Buprestid larva.

The nearest ally of this species is the only other *Hormiopterus* described from South Africa, namely, *H. capensis* Brues, with the type of which it agrees in many respects, but has rudimentary and useless wings, in which respect it also differs from the fourteen other species described from Africa. In details it differs from *H. capensis* in being smaller, in having more slender antennae, different sculptural details, etc. It shares with the European and North African *Chremylus rubiginosus* Nees, another member of the *Hormiinae*, the choice of a coleopterous host.

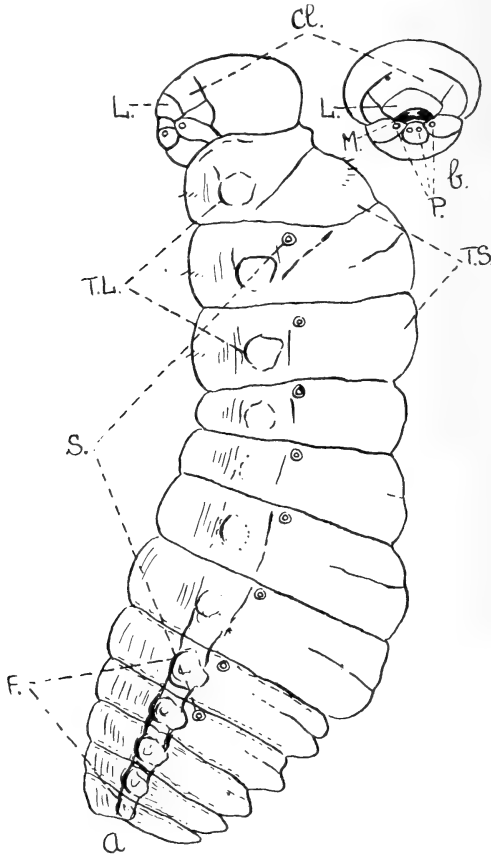
The type material is in the South African Museum.

FAMILY APIDAE.

Subfamily CERATININAE.

Gen. *Ceratina* Latr.*Ceratina* sp. ign.

LARVA (text-fig. 6, *a* and *b*).—White, eruciform, apodous; the apices of the mandibles pale brownish.

TEXT-FIG. 6.—Larva of *Ceratina* sp. ign.

Head feebly chitinated, with the clypeal part broader than long, the suture between it and the head interrupted in the middle, the apical margin feebly emarginate; labrum emarginate apically; mandibles bifid apically, the lower tooth more developed and strongly chitinated; labium with a small papilla on each side; maxillae each with a small papilla; eyes, ocelli or pigment spots absent.

Thorax with the segments distinct, the pronotum divided into two, a neck region and a posterior part, all the segments with microscopic setae in transverse rows, more distinct on the pronotum and on the ventral surfaces, with a spiracle laterally on each side before the middle on meso- and metanotum.

Abdomen with 9 visible segments, more dilated and broader than the thorax from segments 2-4; segments 5-9 being progressively narrower, more transversely convex dorsally; with a lateral projecting fold on each side, more or less broken up into slight tubercles laterally on each segment, more distinct on 5-8, continued on to thorax, where there are also lateral prominences corresponding to legs; with 6 spiracles on each side from segments 1-6, and situated before the middle along anterior margins.

Length about 6-6½ mm.

Breadth about 2½ mm.

Distribution: Somerset West, C.P. (coll. in September, October, and again in April 1931-32).

PUPA.—The pupa is white, with all the characters of an adult *Ceratina* already present, but a determination of the species is impossible from even an advanced pupa, owing to the slight specific differences among the adults themselves in this genus.

ORDER LEPIDOPTERA.

Suborder HETERONEURA.

SUPER-FAMILY PYRALIDINA.

Family PYRALIDAE.

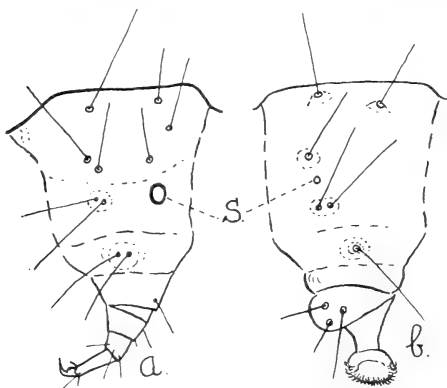
Subfamily PYRAUSTINAE.

Gen. *Phlyctaenodes* Guen.

P. plumbatalis Zell.

LARVA.—The larva of this species feeds on the leaves of *Gnidia laxa* Gilg. during March and April. They have the habit of spinning fine threads from one twig to another, or more often joining adjacent leaves or clusters of leaves together. When disturbed they often become dislodged, but hang on to the fine threads. The fully fed caterpillar becomes sluggish, drops to the ground and entering it spins a cocoon of fine silk to which adheres grains of sand and fine particles of earth. The adult moth emerges after 19 to 20 days.

Body of full-grown larva fresh-green above and below; the head, the coxal parts and the apices of the thoracic legs, the lateral parts of prominences below on segments 1 and 2, the basal parts and apices of the prolegs, lateral parts of prominences below on segments 7-9, and the claspers reddish to reddish-brown (like the tint on the twigs and on some of the leaves of the host plant); a broad lateral band



TEXT-FIG. 7.—Pronotum (a) and abdominal segment (b).

Caterpillar of *Phlyctaenodes plumbatalis*.

above the reddish band on each side, and two narrow, longitudinal, more or less broken-up lines on the dorsum saphron-yellow to yellowish; the crochets on the legs and prolegs brownish; the setae on the head, thorax, and abdomen black and with blackish bases.

Head with the epicranial plates smooth, provided above with four long blackish setae on each side, one near centre opposite adfrontal plates, one laterally in same

line, one on extreme side lateral to ocelli and one behind ocelli, with one shorter, finer, more pallid seta on each side medially near base, with two yellowish setae in front on each side above antennae, the apical one of which is long, with one sublateral between the 3 basal ocelli and three on each side ventrally below ocelli; frons with two longer anterior and two minute posterior yellowish setae; adfrontal plates each with a very fine seta; clypeus slightly darker than epicrania, with a yellowish seta on each side at base and another laterally on each side; ocelli 5 in number, the anterior ones (lower two) smaller; labrum with a transverse row of downwardly directed, short and stout setae near apical margin; antennae distinct, 3-jointed, the apical joint very minute, short, cylindrical, and with a minute erect seta apically, with the apex of joint 2 broad, with a long seta and a short cone medially; mentum with two medial setae; spinneret long, slender, spiniform, and with a spine-like seta in front of it; maxillary palps slender, the apical joint cylindrical.

Thorax with the pronotum (text-fig. 7, a) slightly more elevated than the other two thoracic segments, with five long setae on each side from above to below before the middle, two slender ones on the

coxal part and three on each side in posterior part (see fig. 7, *a*), with a large circular spiracle laterally on each side, with the anterior part dorsally above duller and shagreened; meso- and metanotum each with 8 pairs of setae on each side, the lowermost pair on the coxal part and a solitary, slender seta behind the lateral pair, with no spiracles.

Abdomen with segments 1-8 each provided with 6 setae on each side, the dorsal one before the middle the longest, the second one is just behind the middle and lower down, the third is lateral and before the middle, 4 and 5 constitute a pair before the middle and subventral, the last one is stouter, has a larger black base, and is ventro-lateral on coxal part (text-fig. 7, *b*), with the spiracles on 1-7 small, situated just before middle, that on segment 8 large, larger than one on pronotum; segment 9 is the shortest segment, with 4 setae above on each side, a dorsal one, a very long postero-lateral one, and one projecting over anal part, and with a ventro-lateral one at base of claspers; segments 1, 2, 7, and 8 ventrally below, with a transverse row of four more or less shiny prominences bearing short, yellowish to brownish setae, the lateral ones being larger and each carrying 2 to 3 setae, the medial ones each with a fine and short seta; segments 8 and 9 ventrally each with four smaller shiny prominences, each bearing a single seta, the lateral ones being stouter, longer, and dark.

Locomotory Appendages.—The three pairs of thoracic legs bearing pale setae, a stouter and longer one behind and three shorter inner ones on each basal joint, with two setae on inner side of third joint, a crown of about 6 or 7 setae towards apex of joint 4, of which four are on the inner side, with three small ones round apical part of tarsus, with the exposed part of joint 2 without any setae; prolegs on segments 3-6 with three yellowish setae antero-laterally on a basal prominence, the lateral one the longest, with the planta flat below, rounded and broader than the neck of pedecil just below it, with the crochets arranged biordinally, the circle not being complete, with a gap on the outside, the circle being a little more than a semi-circle, the arrangement thus approaching a penellipse more than a mesoseries; claspers with two basal setae and one apically behind, one basal and one apical on the outer side, and two basal and two apical ones in front, all on the enlarged basal part, with the crochets arranged in a biordinal mesoseries.

ORDER DIPTERA.

Family TACHINIDAE.

Subfamily TACHININAE.

Gen. *Sturmia* Desv.

S. inimica n. sp., 1 ♀.*

Body black, shining, with the usual silvery-whitish dew-like bloom on the head, mesonotum (where it is absent from four longitudinal bands), apical half of scutellum, the basal halves of segments 2-4 of abdomen above, the pleural regions, the basal halves of abdominal segments 1-4 below, the anterior coxae and the outer inner and lower surfaces of the femora; antennae dark blackish-brown, with the inner upper surfaces of joint 2 and more or less the basal and inner upper faces of joint 3 pallid, yellowish; the maxillary palps yellowish, only slightly darkened basally; mouth-opening pallid; a broad central band on vertex, from ocelli to antennae, dark velvety-brown; proboscis with the apex brownish; halteres yellowish-brown; calypteron, alula, and squama whitish; wings hyaline, translucent, the costal vein and apical parts of the other veins dark blackish-brown, their bases more yellowish; the hairs on the occipital region and on the jowls snow-white; the macrochaetae and other bristles on the body and legs black.

Head slightly broader than the mesonotum across humeral calli; vertex about five times as broad as the two posterior ocelli are from each other, more or less plane medially, with 4 post-vertical bristles, with 2 vertical ones on each side, the inner ones the longest, and apically slightly directed backwards, with the row of frontal bristles on each side extending to about opposite arisal insertion on joint 3, composed of 7 bristles, the posterior one slightly more displaced towards the margin of the eye, with the second frontal bristle at the base the longest and stoutest, but shorter than the vertical bristle, with the two fronto-orbital bristles directed forwards and downwards; facial ridges more distinct basally, with two or three very fine facial bristles anteriorly; vibrissal bristles stout and crossing and with 6 bristles below these on each side; genae with about 14 or 15 minute hairs more or less in three rows, the apical row with longer hairs; ocellar region with fine separated hairs and a forwardly

* The remains of another specimen, hatched from a parasitised caterpillar, were subsequently found in a cocoon, and leave no doubt as to the identity of this Tachinid.—AUTHOR.

projecting ocellar bristle on each side; post-orbital bristles the longest just behind eyes, small towards the jowls; antennae with joints 2 and 3 combined about as long as vertex, with 4 short bristles in a row along the anterior margin of joint 2, with joint 3 more or less laterally compressed, concave towards the apex on inside, more or less equally broad throughout its length, the apex rotundately rounded, but more acute, subangular at upper apical angle, a little more than twice as long as joint 2, pubescent and more greyish on the outer surfaces, with the arista about as long as joints 2 and 3 combined, its basal half thickened and its apical half fine and slender, with the basal joint about one-fourth the length of the thickened part and inserted at a little less than one-fourth the length of joint 3 from its base, with the thickened half of the arista finely pubescent and the apical part with minute alternate hairs, the basal joint with a single short bristle near the apex along the upper outer margin; proboscis about as long as face (side view) from base of joint 1 of the antennae to vibrissal bristle, much shorter than head is deep, with the hairs on the apical part yellowish; maxillary palps with the apical parts thickened, club-shaped, and with 2 distinct bristles on lower side of each near base of the apical part.

Thorax with 4 macrochaetae on the humeral callus, with the acrostichal and dorso-central series on each side above not so well developed as the post-humeral, supra- and intra-alar ones; scutellum with 4 macrochaetae on each side along hind margin, the basal ones being very powerful and the third on each side long and slender, longer than prescutum and scutum combined, the fourth or apical one on each side is short; mesopleurae with 6-7 macrochaetae along hind margin and some more slender bristles; sternopleurae with 3 bristles, one posteriorly and two medially; propleural region above the front coxae with an upper and a lower macrochaeta; pteropleurae with a solitary bristle along its upper margin; wings with the combined vein (radial 4 and 5) straight to apex and there very nearly touching the oblique first medial vein, which is nearly straight, slightly wavy, joining the main medial at right angles (the fifth radial cell is thus only slightly open apically on costal margin), with the oblique fourth medial vein only slightly S-curved and joining the medial vein at about a little less than apical third of the distance of fifth radial cell on the medial vein.

Abdomen with the 2 medial bristles on segment 1 not very distinct and not well developed, those on segment 2 stout and straight, directed slightly backwards, with 8 marginal ones on hind margin

of segment 3, of which the four discal ones above are very stout, straight, and powerful, the two medial ones being the longest and the extreme lateral ones above the shortest; the last segment with the bristles arranged more or less in three transverse, irregular rows above, the basal row composed of smallish bristles, the second row of about 8 stouter bristles, of which the two medial ones are the stoutest, the third row composed of two medial ones not so stout as those in front and two or three lateral ones on each side; venter with segment 3 having a transverse row of longer bristles along the hind margin, with numerous downwardly directed bristles on the ventral part of segment 4, of which the discal ones are the stoutest.

Legs with longish slender bristles, more or less in rows along the lower outer part of the anterior coxae, those on middle ones more slender and more in a row; femora with the bristles on the upper surfaces of the front ones comparatively stout and long, and with 7-8 slender, straight bristles along the lower hind margin of the front ones; tibiae with a single long bristle beyond the middle along the outer lower margin on the front ones, with two powerful bristles before the middle along the anterior lateral face and a single much stouter one beyond the middle on the posterior-lateral faces of the intermediate tibiae, with the spines below on the hind ones more developed than those on the front tibiae, with one spine at about the middle of the outer series and another at about the middle of the inner series longer and stouter than the rest.

Length about $5\frac{1}{2}$ mm.

Length of wing about 5 mm.

Distribution: Somerset West, C.P., April 1932. Caught sitting over the head of a caterpillar of *Phlyctaenodes plumbatalis*.

The type specimen is in the South African Museum.

Superficially this new species resembles *S. atropivora* R. Desv. and *S. bimaculata* Hart. It differs from *atropivora* in being comparatively smaller, in having a comparatively longer third antennal joint, less rotundately rounded apically and more angularly produced along the upper apical angle; the thickened part of the arista is less extensive, not extending beyond middle of arista; the second joint of the antennae is longer too and with smaller bristles above; the fifth radial cell of the wings is practically closed on the costa and not wide open, the main medial vein is faintly continued beyond oblique first medial; the macrochaetae on last abdominal segment above are fewer, less stout and the segment is more angularly rounded apically. From *S. bimaculata* it differs in having a comparatively shorter and broader

third joint of the antennae, with fewer and more slender bristles in a row on each side below and behind vibrissal ones, fewer bristles on the maxillary palps; with the oblique first medial vein sharply at right angles to main medial vein, also with the fifth radial cell more closed on costal margin; the marginal macrochaetae on segment 3 of the abdomen above much longer, the bristles on disk of the last segment fewer and comparatively less stout and the segment more angular apically; the middle tibiae with 2 distinct long bristles before middle on the anterior lateral face, etc.

The larvae of this Tachinid is parasitic in the bodies of the caterpillars of the Pyralid *Phlyctaenodes plumbatalis*.

EGGS.—The eggs are deposited and glued on the outside of the caterpillars. The usual number of eggs laid on a single caterpillar is four, three of which are glued on in a triangle behind the head on the pronotum and mesonotum, and one either above the claspers posteriorly or on the side of the body opposite one of the prolegs.

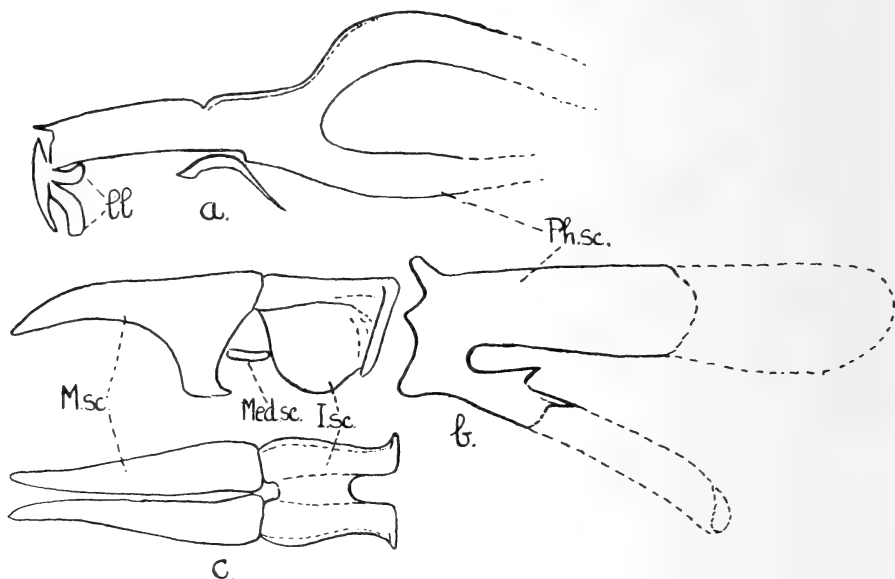
The egg itself is oval, white, shining when fresh, flattened on one side, convex on the other, glued on to the cuticle of the caterpillar by the flattened side.

Length about $\frac{1}{2}$ mm.

LARVA.—The ensuing larva perforates the egg-shell on the glued-on side nearer one pole, where it makes a small circular hole. It may remain attached to this perforation for some time, or it may leave this position and migrate elsewhere, making a new communication with the exterior (see general part).

Body dirty white; the apical part slightly darker; cephalopharyngeal skeleton visible through the anterior part of the body as a black rod. The very young stage, about 1 mm. long, probably representing the first instar, shows no distinct or visible segmentation, but with 12 transverse circlets of minute, microscopic spicules, of which circlets 1 and 2 in the cephalic region are much broader, composed of larger, denser and broader, more flattened spines; row 3 also broader than the posterior ones and with slightly larger spicules; with a cluster of about 5 or 6 larger, more elongate spines, more or less arranged in an arc, one on the ventral side and another on the dorsal aspect at the posterior end, the two middle spines in each cluster being slightly larger; with the rudiments of the posterior spiracles, just below the dorsal cluster of spines, visible under a high power as a tracheal tube ending in the cuticle on each side and showing three indistinct, dark chitinous areas (the future spiracular openings).

Cephalic End narrower and more attenuated, no distinct oral aperture visible as yet; cephalo-pharyngeal skeleton (text-fig. 8, *a*) is a double structure from behind the mandibular sclerites, resembling a tuning-fork; the mandibular sclerites (M.Sc.) seem to be composed of a central piece and two lateral lobes (L.L.) on each side; the cephalo-pharyngeal skeleton of a last instar (text-fig. 8, lateral view *b* and dorsal view *c*), obtained from a puparium, is totally different,



TEXT-FIG. 8.—Cephalo-pharyngeal skeleton of larvae of *Sturmia inimica* n. sp.

and yet there is no doubt that it belongs to the larva of the same fly; with three divisions present, the mandibular sclerites (M.Sc.) as in figure, the intermediate sclerite (I.Sc.) being joined transversely below, and the pharyngeal sclerite (Ph.Sc.), which has a small process anteriorly and dorsally, beyond this the upper part is divided into two wings, the apical halves of which are not completely chitinised, whereas the lower part is not divided, trough-shaped and with a small dentate process basally on each side, with the apical part also incompletely chitinised; a minute, medial, rod-like sclerite (Med.Sc.) is visible ventrally between the mandibular and intermediate sclerites.

Posterior End in the very young stage (about 1 mm. long) blunt, with the posterior fourth bent or curved and the posterior sixth or

seventh fitting into a dark chitinous, socket-like or capsule-like ring in the cuticle of the caterpillar. (This chitinous ring probably represents a sheath in part and also the modified cuticle of the host. The larva is very loosely lodged in this socket, and probably adheres by means of its posterior circlet of spicules or by means of the dorsal and ventral clusters of larger spines.) The advanced stage or last instar has not been studied, but judging from the empty cuticle of the host in the cocoon-case it probably becomes free and feeds on the vital parts of the host. Pupation takes place in the cocoon-case of the host or possibly in the soil also, depending on the extent of the infection and on the period of parasitism prior to pupation on the part of the host (see general part). Only a single parasite is destined to pupate in any one caterpillar.

PUPARIUM.—The puparium is reddish-brown, slightly darker at the ends, broadest near the apical end and at the middle; the cephalic end being broader than the posterior end, broadly and rotundately rounded, with a slight depression in the middle apically, marking the position of the larval mouth, with striae radiating from it and with a feeble, carinate raised line extending from the mouth nearer the dorsal aspect on each side for a short distance, and bearing, on each side near the mouth, a short, cylindrical process (the former anterior spiracles of the last larval instar); the posterior end gradually narrowed from middle to near the anal part, where it is rapidly narrowed, ending in a rounded black boss-like tubercle, the tubercle with a central foveate puncture and another one on the periphery on the dorsal aspect, from which there extends a short cicatrice-like depressed line; three small, oval, raised, shining black prominences on each side dorsally just above the anal boss (the former posterior spiracles of the last instar); anal aperture of the last instar represented by a circular depression on the midline ventrally near the posterior end.

The shape is elongate, slightly dorso-ventrally compressed apically, cylindrical posteriorly, indistinctly segmented, very finely and more or less transversely striated, the cephalic and posterior ends being more coarsely rugulose in sculpture.

Length about 6 mm.

Breadth about $2\frac{2}{3}$ mm.

The period of pupation as well as the periods of the larval instars are as yet unknown.

ORDER THYSANOPTERA.

Suborder TUBULIFERA.

Family IDOLOTHRIPIDAE.

Gen. *Dicaiothrips* Buffa.

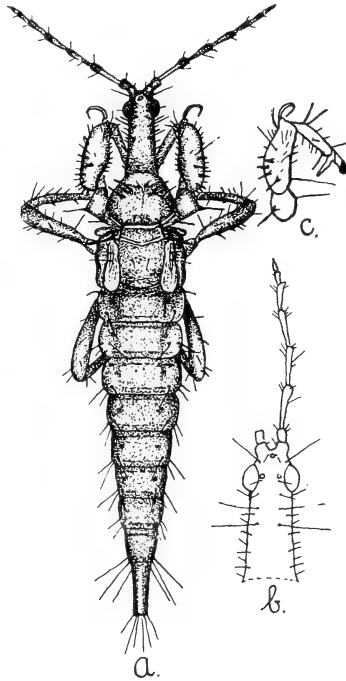
D. gnidivicolus n. sp., 5 ♂♂, 5 ♀♀ (text-fig. 9, ♂).

Body more or less shining black; antennae deep brownish-black to black; joint 2 of the antennae (apex excepted), the sickle-shaped bristle on apex of front femora in the ♂, the apices of the tibiae (variable in extent), the basal joint and tooth-like spine on the anterior tarsi of the ♂, stramineous or yellowish; the setae on the abdomen and the hairs on the legs whitish or sericeous; the trochanters and extreme bases of the femora, the articulating membranes between the abdominal segments shining through more or less reddish to pale yellowish-red; the wings whitish, translucent.

Head elongate, about $\frac{2}{3}$ –1 mm. long above in the ♂, slightly shorter in the ♀, about three times as long to apex of antennal tubercles as broad basally, very slightly broader basally than apically, with the sides almost parallel, very gradually narrowed apically, but about as broad or only very slightly narrower across eyes than base, slightly compressed dorso-ventrally and feebly arched at about the middle, with the integument smooth, shining, with a single anteocular bristle on each side apically, a short, erect bristle behind each lateral ocellus and three postocular discal bristles on each side behind eye (the first one being short like the ocellar bristle, the second the longest, and the third only slightly shorter than the second and situated about half-way from eye to base), all less developed in the ♀; on the sides of the head there is a short stoutish spine-like bristle behind each eye, another short sublateral one near base of second large postocular and about 6–8 short bristles on each side to base, of which 2 or 3 are sublateral on each side in basal half (text-fig. 9, b); the produced part of the head about twice as broad as long; eyes comparatively large, convex; ocelli minute, with the lateral ones situated just before the middle of eyes and the apical one on a slight prominence only very slightly farther away from lateral ones as these are removed from each other; frons below with a fine bristle on each side on a slight prominence at base just below antennal tubercles, and another longer, whitish one on each side apically just before mouth-cone, as well as a few shorter fine ones just overhanging mouth-cone; cheeks

with about 7 short spines on each side from eye to mouth-parts, with the integument shining and more or less transversely wrinkled; mouth-cone bluntly pointed, short, extending to about half the length of prosternum, with a few fine hairs basally in front of the maxillary palps and a few fine ones below apex; labial palps minute; antennae 7-jointed in both sexes, extending to about wing-bases in the ♂, comparatively shorter in the ♀, about reaching posterior margin of pronotum, with joint 1 sub-equal to 6, with joint 2 the longest and 3-5 progressively shorter, with joint 5 slightly produced apically on lower margin, with 7 the shortest and acuminate; in the ♂ with joints 6 and 7 combined subequal to 5 along upper margin, the last 3 joints subequal to 1 and 2 combined; in the ♀ with 5 about half as long as 2, and 6 and 7 combined subequal to 4.

Thorax with the pronotum more or less hexagonal, the base and the postero-lateral sides being more or less straight and carinate, with the apical margin arcuately rounded and the antero-lateral sides broadly rounded; the upper surface slightly transversely depressed in apical part, quadrangulately convex discally, less so in the ♀, with a feeble indication



TEXT-FIG. 9.—*Dicaiothrips gnidiicolus* n. sp. (♂.)

of a central depressed line, more evident posteriorly, with the integument smooth, shining, minutely and microscopically punctured centrally and discally, smooth apically, with 10 distinct spines on the disk, more developed in ♂, five on each side (a small bristle-like spine medially near apical margin, another longer and stouter backwardly directed one laterally in line with the medial one, a longer backwardly directed one laterally on a slight prominence just before middle, an equally stout one postero-laterally and a very fine, erect hair-like one centrally before the base); a postero-lateral plate is present on each side basally above the coxae, each with a small prominence carrying a stout, outwardly and backwardly projecting spine; pterothorax subequal to or slightly shorter than

the pronotum, basally broader than the pronotum, the extreme base or mesonotal and mesopleural part deeply cut off from the posterior part, the sides projecting and prominently carinate; mesonotal part demarcated from metanotal part by a transverse, posteriorly arcuate, carinate ridge, the ridge laterally on each side at base of wings with a stout, erect spine; metanotal region slightly convexly raised in the middle and there with 2 small central bristles, with the integument dull, shagreened like the mesonotal part, with the hind margin rotundately rounded; wings with the tegmina abbreviated, short, narrow, about $\frac{1}{3}$ mm. long or less, about as long or very slightly longer than joints 1 and 2 of the antennae combined, just extending over hind region of mesonotum, broader apically, with the apical margin rounded, with the internal and external margins feebly sinuous before the middle near base, whitish, translucent, and with only one vein from base to beyond middle along outer margin, the vein pale brownish in basal half and carrying two erect bristles before the middle (the posterior one longer), without any fringe of ciliary hairs; hind wings as long as tegmina, but narrower, with an indication of an outer vein in basal half.

Abdomen elongate, about one and a half times as long as head and pronotum combined, with the first five or six segments depressed above, the sides slightly reflected upwards (much less evident in spirit specimens and scarcely shown in text-fig. 9, *a*, which was drawn from a spirit specimen), about as broad or slightly broader than the pterothorax, smooth, shining, gradually narrowed to the tube; segments 2-7 with two long, upwardly and slightly inwardly directed bristles laterally on each side at apex and with a transverse row of separated bristles on hind margins of the sternites below; segment 1 in the ♂ is dorsally scarcely visible, in the ♀ more distinct, its posterior margin arcuately rounded; segment 8 more cylindrical, with the transverse row of bristles very nearly approaching the midline above; segment 9 shorter than 8 (shown longer in the figure, owing to extreme distension), cylindrical and with a transverse row of much longer bristles dorsally and laterally along hind margin, ventrally below in the ♂ with two straight, stouter spines just before the genital aperture; tube about half as long as head, about $\frac{1}{2}$ mm. long, more or less cylindrical, broadest at base, gradually tapering to apex, with a crown of 6-7 bristles, shorter than the tube and slightly shorter than those on segment 8.

Sternum with a few fine whitish hairs on each side and one on each side opposite the coxae; the mesosternal part broad, with the middle

coxae further apart than the posterior and anterior ones; front coxae well developed, enlarged, and visible from above, more developed in the ♂, with a stout, outwardly directed spine-like bristle laterally, stouter in the ♂.

Legs with the anterior femora powerful and incrassate in the ♂, less so in the ♀, subequal in length to the head and very nearly as broad (in ♂), viewed from the side (text-fig. 9, c) slightly arched, unarmed below, in the ♂ obliquely truncated apically, armed with short, stoutish, erect spines and larger, more slender bristles above and on the sides (arranged as shown in text-fig. 9, a and c), with the inner apical part slightly produced and bearing a stout, curved sickle-shaped yellowish bristle; in the ♀ there is no apical sickle-shaped bristle and the bristles are less developed, but in both sexes there is at the base ventrally a very long, slender, hair-like bristle (text-fig. 9, c) and also a shorter one on the coxae; middle and posterior femora with short, separated bristles and with a solitary long hair-like bristle near base below; tibiae with the anterior ones in the ♂ incrassate, shorter than the femora, straight, constricted basally, forming a sort of knee-prominence near the base, which carries two long bristles, with a small prominence ventrally below near apex bearing a bristle and a similar one laterally near apex, the rest of the bristles short; tarsi 2-jointed, with the first joint of the anterior ones in the ♂ provided with a straight, stout, yellowish tooth below, very nearly as long as the entire tarsus in some ♂♂ and much longer than the tarsus is broad, the ♀ without a spur, but often with a very feeble protuberance.

Length about $2\frac{1}{2}$ –4 mm. (The latter distended specimens in fluid.)

Breadth about $\frac{1}{2}$ – $\frac{2}{3}$ mm. across pterothorax.

Distribution: Somerset West, C.P. (Coll. September–October 1931, April 1932.)

The ♂ holotype and ♀ allotype in spirit.

This Thrips, which inhabits and breeds in the empty galleries of *Hoplitopales lineatus* in the thickened stems of *Gnidia laxa*, differs, according to the descriptions, from all other African species of *Dicaiothrips* in the extremely abbreviated condition of the wings, in the different arrangement of the bristles and spines on the head and femora. From *D. drepanifer* Faure, the only other South African species described, it differs, according to the description, in the longer head, different arrangement of the bristles on the head and pronotum, much shorter wings, different shaped and yellowish sickle-shaped bristle on the anterior femora of the ♂, longer spur on anterior tarsus of the ♂, etc. The abbreviated condition of the wings, which are quite useless

for purposes of flight in this species, is probably an adaptation to the cryptic habits of this and similar species. This Thrips is probably not confined to *Gnidia*, but may possibly also inhabit other dark environments, crevices, under bark or leaves, etc.

The whole life-history is passed in the empty galleries in the damp frass of the Curculionid larvae.

EGG (text-fig. 10, *a*).—The eggs are white, laid in clusters but not close together, about equally distant apart, glued on along their longitudinal axis, pointing upwards with one pole; the one pole being more rounded and the other slightly more attenuated, broadest just beyond the middle and in outline slightly curved, the surface smooth, not sculptured.

Length about $\frac{4}{5}$ mm.

LARVAE (text-fig. 10, *b* and *c*).—The larvae are pink or ruby-red in life, the very young stages being more pink; the antennae (excepting the extreme apices), the apical part of the head and head below, the small eye-spots, a small chitinous area on each side of head behind the eye-spots, the two quadrangular plates on the pronotum, the spots or bases of the setae on the dorsal part of the body, the chitinous plates on each side of segment 8, the tube or last two segments, a row of ventral spots on each side of the midline and the legs dark brown to blackish in life.

Head with chitinous plates as shown in the text-figure; antennae with 7 joints (actually 6-jointed, the first being the antennal tubercle), with the second joint the longest, with 3 slightly shorter than tubercle and joint 1 combined, with 4 slightly shorter than 3, with 5 very slightly longer than 6 and shorter than 4, with joint 6 styliform; eyes represented as spots and there is another solitary spot in the middle between the chitinous plates above.

Thorax with the pronotum narrowed in front, broadest just behind the middle, with a large quadrangular, dark-coloured plate on each side discally above; meso- and metanotum not much different from the abdominal segments, the setae and spots arranged as in text-figure.

Abdomen narrowed from segments 7–10, the last two being tubular (in advanced stage), each segment with a transverse row of separated spots (the bases of the setae) at about the middle, of which there are 6 dorsally, one laterally, with a ventral row of spots below on each side (two on a segment) and also on the sterna, with, however, another lateral spot on each segment from segment 7; segment 8, in advanced stages, with a broad basal plate present, which is interrupted in the

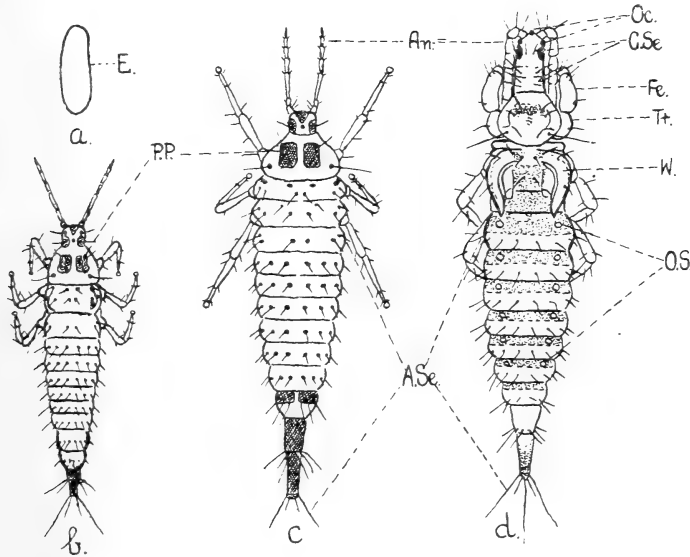
middle (text-fig. 10, c); the tube is already distinct and much longer in advanced larvae.

Legs as shown in the figures, the terminal vesicle well developed; tarsi apparently 1-jointed.

Length of advanced larva about $3\frac{1}{4}$ mm.

Breadth of advanced larva about $\frac{4}{5}$ mm.

The number of moults is unknown, but there are probably three; the very young stages do not differ very much from the last stage,



TEXT-FIG. 10.—Egg, larva, and pupa of *Dicaiothrips gnidiicolus* n. sp.

the tube is shorter, the antennae are less differentiated, and the eighth segment has no dark chitinous basal ring. The thoracic segments are comparatively longer and less differentiated.

PUPA (text-fig. 10, d).—The young pupa is pinkish and the advanced one white; the eyes and the tube blackish; the eyes, ocelli, and last segment of the advanced pupa black; the basal transverse bands on the dorsal parts of the abdominal segments, the dorsum of the meso- and metanotum and an indistinct patch on the pronotum brownish.

Structurally the pupa resembles the adult. The *Head* is much broader than long, with the apex attenuated, with 3 setae on each side above as shown in the figure; eyes distinct; ocelli with the lateral ones just anterior to the eyes and the third at apex just between the antennal insertions; the antennae segmented and flexed under the head, their apices meeting near mouth below.

Thorax with the pronotum already subhexagonal, broadest and more rounded just behind the middle, with the setae distributed as shown in the text-figure; wings short as in the adult, the apices not extending beyond base of segment 2 of abdomen.

Abdomen broad basally, with 9 visible segments and a tube, attenuated from segment 7 to apex, each segment with a basal transverse, more chitinated, dark band, with a clear ocellate spot (O.S.) on each side from 1-7, with the setae distributed as shown in the text-figure (A.Se.); the sternites with the apical margins of the first five segments narrowly and darkly chitinous.

Legs with the anterior femora already thickened as in the adult and the setae more or less arranged as shown in the figure.

Length about $3\frac{1}{2}$ mm.

Breadth about $\frac{5}{6}$ mm.

Distribution: Somerset West, C.P. (coll. September-October 1931, April 1932).

The pupa is capable of movement, and when disturbed was seen to crawl away with such rapidity that it was at first mistaken for some other insect.

All the type material in the South African Museum.

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14. *On Some Collembola-Arthropleona from South Africa and Southern Rhodesia*.—By H. WOMERSLEY, A.L.S., F.R.E.S. (Entomologist, South Australian Museum; late Entomologist, Section of Field and Pasture Pests, Division of Economic Entomology, Australian Council for Scientific and Industrial Research.)

(With 12 Text-figures.)

ALTHOUGH the Collembola fauna of the African Continent is, through the writings of Wahlgren, Schött, Börner, Philiptschenko, Denis, and Handschin gradually becoming known for Egypt, Sudan, Abyssinia, British East Africa, Algeria, Tripoli, and the Cameroons, that is generally the northern and eastern parts of the continent, up to the present our knowledge of the southern half, from the Equator to the Cape, has been extremely scanty.

In 1903 Börner described *Paronella fülleborni*, *Pseudosira nyassica*, *Lepidocyrtinus flavovirens* and *L. annulicornis* from Nyassaland. In 1907, in his paper on the Collembola of East and South Africa and Madagascar, he listed *Axelsonia littoralis* (Mz.) (= *thalasophila* C.B.) from Madagascar, *Lepidocyrtus lanuginosus* Tllbg. s.sp. *ceratoxenus* C.B., Pemba Is., off the coast of Zanzibar, and *Lepidocyrtinus* (*Mesira*) *voeltzkowi* C.B. from Madagascar. From South Africa in 1908 he recorded *Anurida maritima* Guer. from Angra Pequena Bay, S.W. Africa, *Pseudosira nyassica* var. *pallens* C.B. from Little Namaland, *Lepidocyrtinus* (*Mesira*) *laeta* C.B. from Port Nolloth, Little Namaland, and *Cyphoderus colorus* C.B. also from the latter locality. In his paper on New *Cyphoderidae*, Börner described from S.W. Africa and Natal, *Cyphoderus colorus*, *natalensis*, *limboxiphius*, *bidenticulata* (Parona), and *Pseudocyphoderus wasmanni*.

Wahlgren (1908) described the following from Kenya Colony, just south of the Equator: *Proisotoma sjöstedti*, *Dicranocentrus meruensis*, *Lepidocyrtus cyaneus* Tullbg., *fuscatus*, *extensus*, *obtus*, *flavovirens* C.B., *Lepidocyrtinus annulicornis* C.B., *armillata*, *Paronella nigromaculata* Schtt., *fülleborni* C.B.

Then Philiptschenko in 1926 described from material collected in British East Africa, *Pseudachorutes niloticus* Wahl., *mabiriensis*

Philipt., *Ceratrimeria flavantennatus*, C. (*Linnaniemia*) *gigas*, *Achorutes sokolowi*, *Lepidocyrtinus flavovirens* C.B. var. *annulosa* Wahl., *Lepidocyrtus extensus* Wahl., *Dicranocentrus meruensis* Wahl., *D.* (*Heteromuricus*) *dogieli* Philipt., and *Paronella nigromaculata* Schtt.

In 1926 J. M. Brown recorded *Entomobrya minima* Brown from Natal, while in 1929 from Southern Rhodesia I described and recorded the following: *Hypogastrura manubrialis* (Tullbg.), *myrmecophila* Wom., *Xenylla rhodesiensis* Wom., *Lepidocyrtinus* (*Mesira*) *annulicornis* C.B., *Cyphoderus cuthbertsoni* Wom., *africanus* Wom., and *limboxiphius* C.B.

From the Seychelles Carpenter described in 1916 *Achorutes sexoculatus*, *Axelsonia littoralis* (Mz.), *Isotomurus obscurus*, *Dicranocentrus longicornis*, *Entomobrya seychellarum*, *Lepidocyrtus silvestris*, *obscuricornis*, *annulicornis*, *stramineus*, *fryeri*, *imperialis*, *gardineri*, *Acanthurella braueri* C.B., *Paronella coerulea*, *flava*, *Salina scotti*, *celebensis* Schffr. (= *pallida* Carp.), *Cyphoderus insularum*.

The above list totals only 53 species for the whole of Africa lying south of the Equator. Omitting those from the Seychelles and Madagascar we have only 34 known from the mainland.

In 1928 Denis described *Hypogastrura tetrophthalma* and *Vertagopus minos* from Italian Somaliland (9A).

In 1930, while carrying out research in Cape Province on behalf of the Australian Council for Scientific and Industrial Research, I was able to make a considerable collection of this order of insects. In addition I have been able, through the kindness of the Director of the South African Museum, Dr. Gill, to study a large amount of material collected by members of the staff in various parts of South Africa. I have also had small lots of Collembola sent me from time to time by Mr. M. C. Mossop from Southern Rhodesia. I take the opportunity of including the Rhodesian material in this paper, and would here wish to express my sincere gratitude to the above colleagues for their valuable help.

In this paper the following species are recorded or described:—

Hypogastrura armata (Nic.).

- „ *armata* v. *trispina* v. nov.
- „ *pseudopurpurascens* Wom.
- „ *longispina* (Tullbg.).
- „ *viatica* (Tullbg.).
- „ *manubrialis* (Tullbg.).
- „ *manubrialis* v. *neglectus* C.B.
- „ *sahlbergi* v. *rosea* v. nov.

- Xenylla maritima* Tullbg.
Friesea claviseta Axels.
Polyacanthella barnardi sp. nov.
Certrimeria flavoantennatus v. *capensis* v. nov.
Brachystomella parvula (Schffr.).
 " *capitata* sp. nov.
Anurida maritima Guer.
Achorutes natalensis sp. nov.
Onychiurus fimetarius (L.).
Tullbergia callipygos C.B.
 " *krausbaueri* C.B.
Isotomodes productus (Axels.).
Isotomurus palustris (Müll.).
 " *palustris* v. *balteata* Rt.
Isotoma mauretanica Handschin.
 " *bituberculata* Wahl.
 " *mossoi* sp. nov.
Proisotoma schötti (D.T.).
 " *ripicola* Linnan.
 " *africana* sp. nov.
Vertagopus minos Denis.
Entomobrya decemfasciata Pk.
 " *nivalis* f. *immaculata* Schffr.
 " *nivalis* f. *maculata* Schffr.
Lepidocyrtus lanuginosus Gmel.
Pseudosira grisea sp. nov.
 " *grisea* v. *annulata* v. nov.
Lepidocyrtinus incertus Handschin.
 " *pseudocoeruleus* Den.
 " *cooperi* v. *barnardi* v. nov.
 " *capensis* sp. nov.
 " *flavovirens* C.B.
 " *flavovirens* v. *annulosa* Wahl.
 " *annulipes* Handschin.
Neophorella dubia gen. et sp. nov.
Cyphoderus natalensis C.B.
 " *arcuatus* v. *aethiopicus* Handschin.

Of this list 33 species and 11 varieties are new to Southern Africa, and 19 species and 8 varieties are additions to the continent as a whole. One genus, 8 species, and 5 varieties are new to science. The total species now known to occur in the continent number 160.

At the end of the paper the distribution of species throughout the country is given in tabular form.

COLLEMBOLA-SYMPHYPLEONA Börner, 1901.

SUPERFAMILY PODUROIDEA (*Poduromorpha* Börner, 1913).

Family HYPOGASTRURIDAE Börner, 1913.

Genus HYPOGASTRURA Bourlet, 1839, Börner, 1906.

syn. = 1746, *Podura* Linné (ad partem).

1835, *Achorutes* Templeton (ad partem).

1839, *Hypogastrura* Bourlet.

1872, *Achorutes* Tullberg.

1896, *Schöttella* Schäffer.

Subgenus HYPOGASTRURA s. str. Börner, 1906, Linnaniemi, 1912.

syn. = 1896, *Achorutes* Schäffer (ad partem).

1901, *Achorutes* Börner (ad partem).

1906, *Hypogastrura* s. str. Börner (ad partem).

HYPOGASTRURA ARMATA (Nicolet), 1841.

(Text-fig. 1.)

Podura armata Nicolet, 1841.

Achorutes armatus Tullberg, 1871.

„ *boletivorus* Packard, 1873.

„ *texensis* Packard, 1873.

„ *pratorum* Packard, 1873.

„ *marmoratus* Packard, 1873.

„ *filiformis* Wahlgren, 1906.

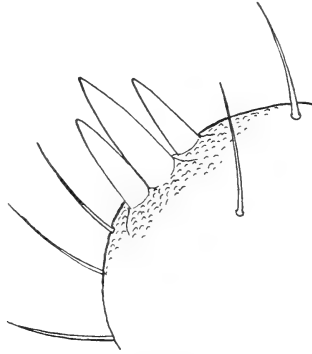
Hypogastrura armata (Axelson) Linnaniemi, 1912.

A cosmopolitan species which appears to be widely distributed in South Africa. It has been taken at the following places:—

Inchanga, Natal, Nov. 1917 (K. H. Barnard); Langklip Siding, Gordonia, C.P., Aug. 1925 (K. H. B.); Stellenbosch, C.P., 24th July, 12th Aug. 1930 (H. W.); Kloof Nek, Cape Town, 27th Aug. 1930 (H. W.); Cape Town, 30th July 1930 (H. W.); Stellenbosch, C.P., 28th Aug. 1927 (A. J. Hesse).

Among the specimens which were collected at Stellenbosch in 1927 by Dr. A. J. Hesse was a single abnormal specimen. In this there were three anal spines instead of the usual two. Such three-

spined varieties are by no means uncommon in many species of *Hypogastrura*, but usually the additional spine is placed posterior to the others. In this particular specimen, however, the third spine is situated immediately between the others and laterally touching them (text-fig. 1). It is, moreover, longer than the normal pair and all three are straighter than usual. It is doubtful whether one is justified in proposing a varietal name for what is probably only an aberration, but if so, then the name *trispina* n. var. would be applicable, as a three-spined variety of this species has not previously been recorded. Type in the Cape Town Museum.



TEXT-FIG. 1.—*Hypogastrura armata* (Nic.) var. *trispina* v. n. Anal spines.

HYPOGASTRURA LONGISPINA (Tullberg), 1876.

Achorutes longispina Tullberg, 1876.

Hypogastrura longispina (Axelson) Linnaniemi, 1911.

Specimens of this species, which is very closely related to the preceding, were collected by Dr. K. H. Barnard at Inchanga, Natal, Nov. 1917, and also at Langklip Siding, Gordonias, C.P., Aug. 1925.

HYPOGASTRURA PSEUDOPURPURASCENS Womersley, 1928.

Hypogastrura purpurascens Linnaniemi, 1912 (ad partem).

Taken by the author in the outskirts of Cape Town, 24th Aug. 1930.

HYPOGASTRURA VIATICA (Tullberg), 1872.

Achorutes viaticus Tullberg, 1872.

„ *murorum* Lubbock, 1873.

„ *humicola* Meinart, 1896.

Hypogastrura viatica (Axelson) Linnaniemi, 1911.

This is another species which seems to be acquiring a cosmopolitan status. Early in 1930 Prof. W. D'Arcy Thompson very kindly sent me a tube of Collembola collected on shore pools at Sea Point, Cape

Town, in Sept. 1929. On examination, all the specimens proved to be this species and not the expected littoral species of *Anurida*.

HYPOGASTRURA MANUBRIALIS (Tullberg), 1869.

Achorutes manubrialis Tullberg, 1869.

„ *schötti* Reuter, 1895.

„ *assimilis* Krausbauer, 1898.

„ *neglectus* Börner, 1901.

The typical form of this widely distributed species was plentiful in material from Kimberley, Feb. 1915 (Miss Wilman), and was also found by the author in the following localities:—

Elsenberg, 24th July 1930; Rondebosch, C.P., 29th July 1930; Stellenbosch, C.P., 24th July, 29th Aug. 1930.

var. NEGLECTUS Börner, 1901.

Achorutes neglectus Börner, 1901.

This variety lacks the two anal spines. It was taken at Stellenbosch, C.P., 29th Aug. 1930 (H. W.).

HYPOGASTRURA SAHLBERGI (Reuter), 1895.

Achorutes sahlbergi Reuter, 1895.

„ *schneideri* Schäffer, 1896.

Hypogastrura sahlbergi (Axelson) Linnaniemi, 1912.

var. ROSEA n. var.

Agreeing with the type form in everything except colour. In life it is of a beautiful pink shade and was found in fair numbers on some damp rocks near the top of Lion's Head, Cape Town, on 30th July and 3rd Aug. 1930 (H. W.).

Genus XENYLLA Tullberg, 1896.

XENYLLA MARITIMA Tullberg, 1896.

Xenylla brevicauda Reuter, 1895.

This is a fairly common species in the Cape Town district and was found by the author at Stellenbosch, 12th Aug. 1930, Fish Hoek, 23rd Aug. 1930, and Hout Bay, Aug. 1930.

Genus FRIESEA Dalla Torre, 1895.

syn. = 1871, *Triaena* Tullberg.

1892, *Pseudotullbergia* Schäffer.

1893, *Oudemansia* Schött.

1894, *MacGillivraya* Grote.

1901, *Achorutoides* Willem.

FRIESEA CLAVISSETA Alexson, 1900.

? *Friesea caldaria* Guthrie, 1903.

A few specimens of this European species were found under the loose damp bark of a fallen log at Stellenbosch, C.P., 12th Aug. 1930 (H. W.).

Genus POLYACANTHELLA Schäffer, 1897.

syn. = 1925, *Conotelsa* Denis.

1931, *Friesea* Denis.

POLYACANTHELLA BARNARDI n. sp.

(Text-fig. 2, *a-d.*)

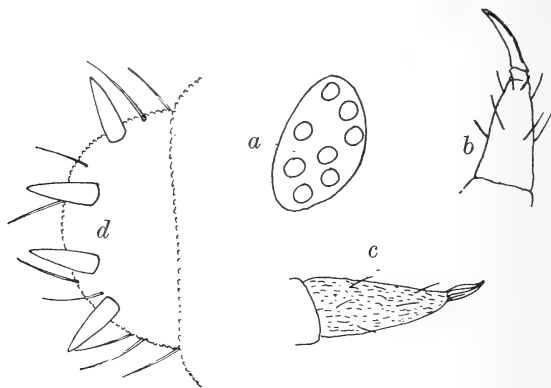
Description.—Length to 1.4 mm. Colour entirely blue-black. Antennae shorter than head; segments I : II : III : IV = $1\frac{1}{4}$: $1\frac{1}{4}$: 1 : $\frac{3}{4}$; IV with trilobed apical knob and an uncertain number of olfactory hairs. Mouth-parts suctorial. Ocelli 8 on each side on a darker patch, equal. Postantennal organ wanting. Claws long and narrow, without teeth. Empodial appendage absent. Tibiotarsus without clavate hairs. Furca well developed; mucro with inner and outer lamellae; dentes 4 times as long as mucro. Clothing of long, fine, and fairly abundant setae; cuticle strongly granular. Anal spines 4 in a transverse row on abd. VI, long, straight, and not on papillae.

Co-types in Cape Town Museum.

Locality.—In numbers, Delagoa Bay, Oct. 1912 (K. H. B.).

This species comes very close, according to the table given by Denis (1931), to *Friesea (Polyacanthella) coerulea* (Schött) (syn. *Oudemansia c.* Schött). In his excellent work on the Collembola of Costa Rica (Denis, 1931) M. Denis discusses very fully the two genera *Friesea* and *Polyacanthella*, and mainly because *Friesea Bodenheimeri*, described by Börner (1927) from Palestine, has 5 (curved) anal spines instead of the usual 2–3, hitherto taken as the character separating *Friesea*, he has placed all the species together under the prior name of *Friesea*. While hesitating to disagree with the views of such an able Collembologist as M. Denis, I think that there is an essential

and important difference in the very nature of the anal spines of the two genera. In *Friesea* they are generally small, evenly curved, and arise from very definite papillae. In all species which have been described under the name of *Polyacanthella* they are usually much longer, straight, and there is no sign of any papillae. It



TEXT-FIG. 2.—*Polyacanthella barnardi* n. sp.

still seems preferable to retain *Polyacanthella* as separate from *Friesea* on these grounds, and as follows:—

Anal spines 3, one behind, two in front, occasionally 0, 2, or 5, but always curved and arising from distinct papillae. Furca reduced. Ocelli 8 or less. Empodial appendage absent.

Genus FRIESEA Dalla Torre, 1875.

Anal spines 4 or more, always straight and not on papillae.

Genus POLYACANTHELLA Schäffer, 1897.

In the latter genus would be included *P. afurcata* Denis, *P. acuminata* Denis, *P. brevicauda* Schäffer, and *quiquispinosa* Wahlgren, as well as the new species described above.

Genus CERATRIMERIA Börner, 1906.

syn. = 1896, *Schöttella* Schäffer (ad partem).

1929, *Linnaniemia* Handschin.

CERATRIMERIA FLAVOANTENNATUS (Philipschenko), 1926.

Pseudachorutes flavoantennatus Philipschenko, 1926.

var. *capensis* n. var.

This variety agrees more with *P. flavoantennatus*, described by Philipschenko from British East Africa, than with *P. mirabilis*

Handschin from Abyssinia. It is deep blue in colour, even on the apical antennal segments, but has conspicuous lateral yellowish-white spots on the head, thorax II and III, abdomen II, IV, and a medial spot on V. The ocelli are 8 on each side. The post-antennal organ resembles that of *flavoantennatus* rather than *mirabilis*. The furca, however, recalls that of the latter species.

In his paper (1929) Handschin expresses his own doubts as to whether his species was really more than a variety of *flavoantennatus*. This intermediate form from South Africa tends to confirm these doubts and it seems reasonable to consider *mirabilis* as a variety of the British East African species.

Localities.—Inchanga, Natal, Nov. 1917 (K. H. B.); slopes of Table Mt., Cape Town, 5th Aug. 1919 (K. H. B.), same locality 29th Aug. 1930 (H. W.).

Co-types in Cape Town Museum.

On the genus Ceratrimeria.

Denis (1931) has very helpfully revised the known forms of this and the allied genus *Pseudachorutes*, from which *Ceratrimeria* differs in the great development of paratergites. He has, however, placed *flavoantennatus* in the genus *Pseudachorutes* on the ground that Philpitschenko's figure does not so definitely show the paratergites characteristic of Börner's genus. Handschin expressed the opinion that his species *mirabilis* is very similar to *flavoantennatus*, and *mirabilis* is definitely placed by Denis in *Ceratrimeria*. The new variety described in this paper is intermediate and is very definitely also a *Ceratrimeria*, so that I have no hesitation in removing typical *flavoantennatus* from *Pseudachorutes* and putting it in the genus *Ceratrimeria*.

Note.—Throughout Denis's paper it should be noticed that *Ceratrimeria* is invariably spelt wrongly as *Ceratimeria*.

Genus BRACHYSTOMELLA Agren, 1903.

syn. = 1896, *Schöttella* Schäffer (ad partem).

1903, *Brachystomella* Agren.

1905, *Schöttellodes* Becker.

1906, *Chondrachorutes* Wahlgren.

BRACHYSTOMELLA PARVULA (Schäffer), 1896.

Schöttella parvula Schäffer, 1896.

„ *media* Axelson, 1900.

Chondrachorutes wahlgreni Denis, 1924.

Schöttella minor Schtscherbakow, 1899.

? „ *crassicornis* Schött, 1902.

? *Brachystomella maritima* Agren, 1903.

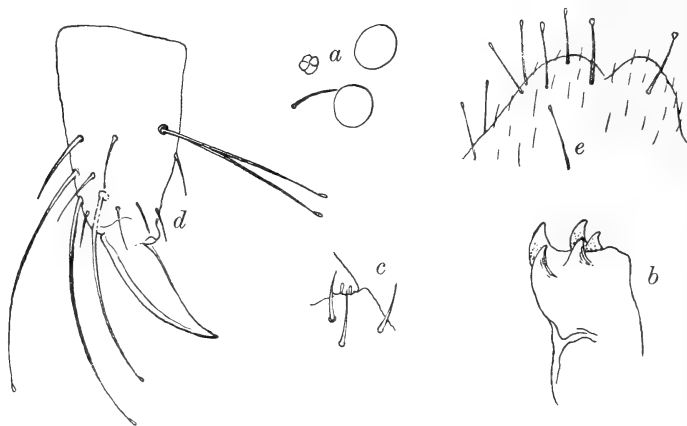
This is a common species in South Africa occurring on cultivated land, amongst decaying vegetable matter, under bark, in fungi, etc., and is possibly an introduction from Europe. It has been found in the following localities:—

Burghersdorp, Jan. 1913 (Robertson); Cape Town, 9th May 1916 (K. H. B.); Elsenberg, C.P., 24th July 1930 (H. W.); Rondebosch, C.P., July 1930 (H. W.); Kloof Nek, Cape Town, 3rd Aug. 1930 (H. W.); Stellenbosch, C.P., 19th Aug. 1930 (H. W.).

BRACHYSTOMELLA CAPITATA n. sp.

(Text-fig. 3, a-e.)

Diagnosis.—Length 1.5 mm. Colour brownish with darker fine mottlings. Antennae slightly shorter than, segments I : II : III : IV = 1 : 1 : 1½ : 1½, III and IV separated, III with normal sensory organ, and IV with apical exsertile knob. Ocelli 8 on each side on



TEXT-FIG. 3.—*Brachystomella capitata* n. sp.

a dark patch, equal; post-antennal organ present, 4-lobed, small. Mandible wanting, head of maxillae broad and toothed. Claws strong without inner teeth. Emp. appendage absent. Tibiotarsus with 2-3 outer subapical clavate hairs reaching beyond tip of claws and also with 2 others, equally clavate, on inner face about the

middle. Furca wanting. Anal spines wanting. Clothing of long, fine, distinctly capitate setae.

Co-types in the Cape Town Museum.

This species will probably be found to be widely distributed in South Africa. It occurs in similar habitat to the preceding and has been found at Cape Town, June 1915 (K. H. B.), and Stellenbosch, C.P., 12th Aug. 1930 (H. W.).

Genus ANURIDA Laboulbene, 1865.

ANURIDA MARITIMA Laboulbene, 1865.

This littoral species was recorded by Börner (1908) from specimens collected by Dr. L. Schulze at Angra Pequena (= Lüderitzbucht, South-West Africa) in July 1903. The author has examined specimens from the following localities:—

Saldanha Bay, C.P., 5th Sept. 1912 (K. H. B.); Cape Peninsula, 1914 (K. H. B.); Melkbos Strand, C.P., 28th Oct. 1927 (K. H. B.); Kleinmond, C.P., Feb. 1927 (K. H. B.); Durban, Natal, Jan. 1913 (K. H. B.); Hout Bay, C.P., 11th Feb. 1914 (K. H. B.); Sea Point, Cape Town, 31st July 1930 (H. W.); Muizenberg, C.P., 26th July 1930 (H. W.).

Genus ACHORUTES Templeton, 1835.

syn. = 1835, *Achorutes*, Templeton (ad partem).

? 1840, *Blax*, Koch.

1842, *Anoura*, Gervais.

1869, *Anura*, Tullberg.

1893, *Neanura*, MacGillivray.

ACHORUTES NATALENSIS n. sp.

(Text-fig. 4, a-c.)

Description.—Length 2 mm. Colour (in spirit) yellowish-white. Antennae shorter than head, segments subequal, I and II with outstanding long, clavate, serrated setae, III with normal sensory organ, IV with at least 3 olfactory hairs. Ocelli 2 on each side, not pigmented, situated as in figure. Claws strong, unarmed. Body tubercles granular and disposed in a normal manner, but the long setae are mainly clavate and serrated.

Co-type in Cape Town Museum.

This species was represented by 2 specimens from Inchanga, Natal, collected by Dr. Barnard in November 1917. It differs from



TEXT-FIG. 4.—*Achorutes natalensis* n. sp.

A. montanus Handschin (1929), from Abyssinia, and *A. sokolowi* Philpitschenko, from British East Africa in the nature of the setae, and from the latter in the unarmed claws.

Family ONYCHIURIDAE Börner, 1913.

syn. = *Aphorurinae* Börner, 1901.

Aphorurini Börner, 1901.

Genus ONYCHIURUS Gervais, 1841, Börner, 1901.

syn. = 1758, *Podura* Linnè (ad partem).

1838, *Lipura* Burmeister (ad partem).

1841, *Onychiurus* Gervais (in litt.).

1841, *Anurophorus* Nicolet (ad partem).

1843, *Adicranus* Bourlet (ad partem).

1893, *Aphorura* MacGillivray.

1909, *Protaphorura* Börner.

ONYCHIURUS FIMETARIUS (Linnè, Lubbock).

Podura fimetaria Linnè, 1766.

Lipura fimetaria Lubbock, 1867.

„ *inermis* Tullberg, 1869.

„ *wrighti*, Carpenter.

Aphorura inermis Schäffer.

Onychiurus pseudofimetarius Folsom.

A well-known inhabitant of soils in many parts of the more tem-

perate countries, particularly in the Northern Hemisphere. It often occurs at the roots of plants in sufficient numbers to do considerable damage.

Cape Town, under stones, etc., 3rd Aug. and 6th Sept. 1930 (H. W.).

Genus TULLBERGIA Lubbock, 1876.

syn. = 1900, *Stenaphorura* Absolon.

1901, *Mesaphorura* Börner.

1902, *Börneria* Willem.

TULLBERGIA KRAUSBAUERI Börner, 1901.

Specimens agreeing completely with this European species were found by the author in the following localities:—

Hout Bay, C.P., under stones, 4th Aug. 1930; Cape Town, 19th Aug. 1930; Stellenbosch, C.P., 18th Aug. 1930.

TULLBERGIA CALLIPYGOS Börner, 1901.

In similar habitat to the above at Cape Town, Aug. 1930 (H. W.).

SUPERFAMILY ENTOMOBRYOIDEA (*Entomobryomorpha*,
Börner, 1913).

Family ISOTOMIDAE Börner, 1913.

Genus ISOTOMODES (Axels.) Linnaniemi, 1907.

syn. = 1903 *Isotoma* Axelson (ad partem).

ISOTOMODES PRODUCTUS (Axelson), 1907.

Isotoma elongata Axels., 1903 (nec. MacGill., 1896).

„ *producta* Axelson, 1906.

A rare species in Europe, it was found by the author under stones on Signal Hill, Cape Town, 31st Aug. 1930.

Genus ISOTOMURUS Börner, 1903.

syn. = 1776, *Podura* Müller (ad partem).

1839, *Isotoma* Bourlet (ad partem).

ISOTOMURUS PALUSTRIS (Müller), 1776.

Podurus palustris Müller, 1776.

Isotoma palustris Tullberg, 1872, Lubbock, 1873, Reuter, 1876 (ad partem), 1880.

Isotoma aquatilis Lubbock, 1873 (ad partem).

„ *stuxbergi* Tullberg, 1876, Moniez, 1891, Jacobson, 1898.

Isotomurus palustris Börner, 1903.

Isotoma tricolor Packard, 1873.

„ *aequalis* MacGillivray, 1893.

Two specimens were found of the typical form of this widely distributed insect at Ceres, C.P., Oct. 1927 (K. H. B.).

var. *BALTEATA* Reuter, 1876.

Taken on Table Mountain, Cape Town, 12th Sept. 1913 (K. H. B.), and at Stellenbosch, C.P., 28th Aug. 1927, by Dr. Hesse.

Genus *ISOTOMA* Bourlet, 1839.

syn. = 1740, *Podura* Linnè.

1841, *Desoria* Agassiz.

Subgenus *ISOTOMA* s. str. Börner, 1906.

ISOTOMA MAURETANICA Handschin, 1926.

Specimens referable to this species, which was described by Prof. Handschin from Algeria, have been taken in South Africa as follows:—

Table Mountain, Cape Town, 4th June 1913 (K. H. B.); Stellenbosch, C.P., 7th July 1930 (H. W.).

ISOTOMA BITUBERCULATA Wahlgren, 1906.

Proisotoma bituberculata Börner, 1907.

This species was described somewhat insufficiently by Wahlgren from Egypt in 1906. Börner later referred it doubtfully to the genus *Proisotoma*. Handschin in 1926 found it in material from Algeria, and his description and figures, as pointed out by Denis (1931), show conclusively that it is a true *Isotoma*. Many specimens were present in material collected at Inchanga, Natal, by Dr. Barnard in Nov. 1917, and from these the author unhesitatingly confirms the conclusion of Handschin and Denis.

ISOTOMA MOSSOPI n. sp.

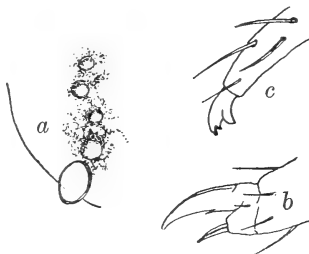
(Text-fig. 5, a-c.)

Description.—Length 0.6 mm. Colour whitish-grey, lightly flecked with bluish pigment, rather darker around the ocelli. Ocelli 4 on

each side, almost in a straight longitudinal line and not on a distinct patch, anterior ocellus the largest. Post-antennal organ broadly elliptical, more than 2 ocelli in length. Antennae half as long again as the head, segments I : II : III : IV = 10 : 15 : 15 : 25; antennal organ III indeterminate. Claw with strong inner tooth. Empodial appendage as in figure. Tibiotarsus without clavate hairs. Furca reaching ventral tube, mucro with 3 teeth, proximal tooth larger than anteapical tooth. Clothing of fairly numerous simple setae.

Co-type in Cape Town Museum.

Localities.—Several specimens were taken in soil at the Experimental Station, Salisbury, S. Rhodesia, by Mr. M. C. Mossop, on 16th June 1932. Coll. No. 3159.



TEXT-FIG. 5.—*Isotoma mossopi* n. sp.

Subgenus VERTAGOPUS Börner, 1906.

VERTAGOPUS MINOS Denis, 1928.

(Text-fig. 6, a-g.).

Locality.—Gatooma, S. Rhodesia, 16th Dec. 1930 (M. C. Mossop).

This very interesting species was described from Italian Somaliland by Denis in 1928 (9A). It is remarkable in that, like *Guthriella muskegis* (Guthrie) from Minnesota, U.S.A., the male exhibits extreme secondary modifications. In the American form the male has very strong lateral horn-like extensions of the posterior abdominal segments and numerous clavate ciliated setae on the abdomen. The African species shows a pair of long curved horns on the head as well as a number of long straight spines. The latter are also present on the sides of the thoracic segments. On abdomen III and IV laterally is a pair of long pointed and ciliated setae, and on IV and V a transverse series of shorter ciliated setae. The data supplied by Mr. Mossop is of interest and I quote it here in full:

"On wet soil in colonies of many thousands and of various shapes, up to 8 feet long by 3 or 4 inches wide; sometimes in irregular patches up to 18 inches in diameter, appearing as a purplish slaty powder."

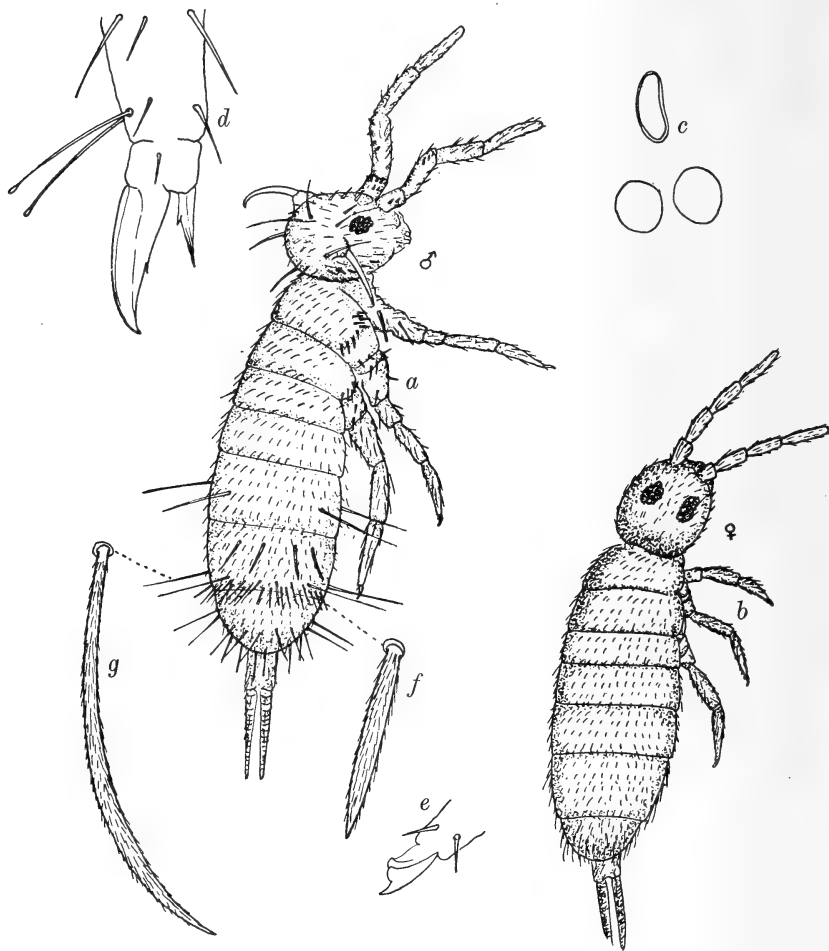
Specimens were sent from two colonies, in one of which the insects appeared to be much smaller in size. In this lot no adults could be found, but the specimens were identical with immature ones in the other tube, which contained also adults of both sexes.

Genus PROISOTOMA Börner, 1906.

syn. = 1871, *Isotoma* Tullberg (ad partem).

1901, *Proisotoma* Börner (as subgen., ad partem).

1906, „ Börner (as genus).



TEXT-FIG. 6.—*Vertagopus minos* Denis.

PROISOTOMA SCHÖTTI (Dalla Torre), 1895.

Isotoma litoralis Schött, 1893, Reuter, 1895.

„ *schötti* Dalla Torre, 1895.

„ *lacustris* Schött, 1896.

Proisotoma schötti (Axelson) Linnaniemi, 1907.

This European species is most probably an introduction to South Africa in agricultural material. The specimens agreed entirely with typical European ones, except that they were banded as in var. *balteata* Reuter of *Isotomurus palustris* Müller. Several specimens were present in material collected by Dr. Hesse at Stellenbosch, C.P., 28th Aug. 1927.

PROISOTOMA RIPICOLA Linnaniemi, 1914.

? *Isotoma agilis* Schtscherbakow, 1899.

Two normal specimens of this European form were present in Tube No. 2605, collected at the Experiment Station, Salisbury, S. Rhodesia, March 1930. The insects were taken under mown grass by Mr. Cuthbertson.

While normal and agreeing with Linnaniemi's description and figures, they exhibit a slight difference in that the post-antennal organ is distinctly notched at the sides and not entire. Whether such a character as this should be considered as specific is doubtful.

PROISOTOMA AFRICANA n. sp.

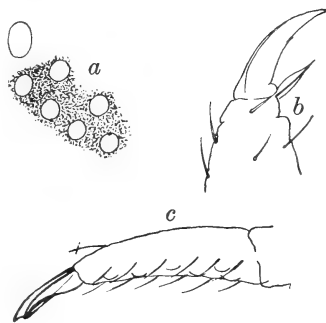
(Text-fig. 7, a-c.)

Description.—Length 0.5 mm. Colour bluish-violet. Eye patches black. Ocelli 6 on each side. Post-antennal organ broadly oval and a little longer than a single ocellus. Antennae shorter than head, segments I:II:III:IV = $\frac{1}{2}$:1:1 $\frac{1}{4}$:2 $\frac{1}{4}$. Claw short with a single fine inner tooth. Empodial appendage with broad inner and narrow outer lamellae. Furca barely reaching ventral tube, dentes with many setae dorsally, twice as long as mucro, mucro with 2 distal teeth and inner and outer lamellae. Thorax II dorsally equal to III; abd. III:IV = 2:3. Clothing of numerous fine simple setae. Rami with 4 barbs.

Co-types in Cape Town Museum.

Localities.—In large numbers on rain pools at Kimberley, Feb. 1915 (Miss Wilman), and in the same habitat and numbers at Cape Town, June 1915 (K. H. B.).

In his excellent table of the known species of this genus (Denis,



TEXT-FIG. 7.—*Proisotoma africana* n. sp.

1931), this new species would come very close to *P. centralis* D. and *P. filifera* D., both from Trinidad. It is somewhat intermediate in that it agrees with the first in having only a very short filament to the empodial appendage and only six pairs of setae on the dentes. With the latter it agrees in the inner tooth of the claw. The mucro differs in length and shape from both.

Family ENTOMOBRYIDAE Börner, 1913.

Genus ENTOMOBRYA Rondani, 1861.

syn. = 1740, *Podura* Linnè (ad partem).

1838, *Choreutes* Burmeister (ad partem).

1839, *Isotoma* Bourlet (ad partem).

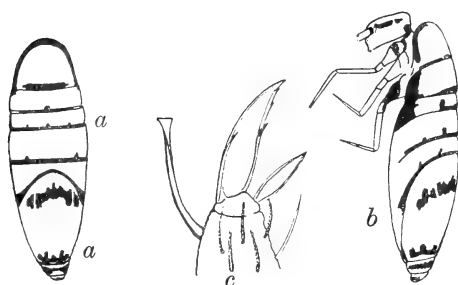
1841, *Degeeria* Nicolet (ad partem).

1861, *Entomobrya* Rondani.

ENTOMOBRYA DECEMFASCIATA Packard, 1873.

(Text-fig. 8, a-c.)

This species has only recently been rediscovered in Mexico (Handschin, 1928). It is now known to occur in most temperate



TEXT-FIG. 8.—*Entomobrya 10 fasciata*
Pk., Handschin.

parts of the world, including Europe. Denis (1931) in remarking on this species regrets that Handschin has not given any details or figures of the claws. I therefore reproduce Handschin's figures of the entire insect and add a figure of the front claw. In South Africa it

was found in some numbers amongst shore herbage at Muizenberg, C.P., on 25th July 1930 (H. W.), and it was also present in material collected by Mr. M. C. Mossop from under mown grass at the Experiment Station, Salisbury, S. Rhodesia, March 1930.

ENTOMOBRYA NIVALIS Linnè, 1758.

f. IMMACULATA Schäffer, 1896.

Entomobrya nivalis-pallida Carl, 1901.

Degeeria lanuginosa Nicolet, 1841.

Entomobrya multifasciata-lanuginosa Brook, 1884.

„ *flava* Lie-Pettersen, 1896.

Locality.—Rondebosch, C.P., 29th July 1930 (H. W.).

f. *MACULATA* Schäffer, 1896.

Degeeria nicoleti Lubbock, 1876.

Entomobrya muscorum-nicoleti Agren., 1903.

„ *multifasciata-nicoleti* Brook, 1884.

Localities.—Stellenbosch, C.P., 28th Aug. 1927 (Hesse); 8th Aug. 1930 (H. W.); Rondebosch, C.P., 29th July 1930 (H. W.).

Both these forms are well-known European insects and are probably introductions into South Africa.

Genus *LEPIDOCYRTUS* Bourlet, 1839.

syn. = 1767, *Podura* Linnè (ad partem).

1840, *Paidium* Koch.

1841, *Cyphodeirus* Nicolet (ad partem).

LEPIDOCYRTUS LANUGINOSUS (Gmelin), Tullberg (1788), 1871.

Podura lanuginosa Gmelin, 1788.

Lepidocyrtus aeneus Nicolet, 1841.

„ *albicans* Reuter.

„ *fuscatus* Uzel, 1890.

„ *montanus* Carl, 1901.

„ *pusillus* Linnè, 1767.

This is almost a cosmopolitan species. In Africa it has been recorded by Börner (1906) from the Island of Pemba, off Zanzibar, under the subspecies *ceratoxenus*. In South Africa and Rhodesia the author has examined typical specimens from the following localities:—

French Hoek, C.P., at 2000 feet, Dec. 1916 (K. H. B.); Experiment Station, Salisbury, S. Rhodesia, March 1930 (M. C. M.); Kloof Nek, Cape Town, 27th July 1930 (H. W.); Rondebosch, C.P., 19th July 1930 (H. W.); Stellenbosch, C.P., 12th Aug. 1930 (H. W.); Signal Hill, Cape Town, 31st Aug. 1930 (H. W.); Cape Town, 24th Aug. 1930 (H. W.); Hout Bay, C.P., 30th Aug. 1930 (H. W.); Kirstenbosch, C.P., 2nd Aug. 1930 (H. W.).

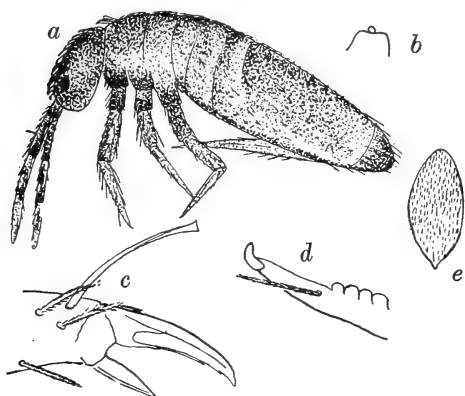
Genus *PSEUDOSIRA* Schött, 1893.

PSEUDOSIRA GRISEA n. sp.

(Text-fig. 9, *a-e*.)

Description.—Length 2.2 mm. Colour entirely bluish-black, except the furca, tibiotarsi and apical antennal segments, which are

somewhat lighter. Eyes 8 on each side on a black patch. Antennae $2\frac{1}{2}$ times as long as head, segments I : II : III : IV = $3\frac{1}{2}$: 5 : 5 : $7\frac{1}{2}$, IV with apical knob and unannulated. Th. II : III : abd. I : II : III : IV : V : VI = 7 : 4 : 3 : 4 : 4 : 15 : 3 : $1\frac{1}{2}$. Claw with two inner



TEXT-FIG. 9.—*Pseudosira grisea* n. sp.

teeth; empodial appendage lanceolate, simple. Tibio-tarsal spatulate seta as long as claw. Furca reaching past ventral tube, mucro falciform without basal spine, unannulated portion of dentes slightly more than twice as long as mucro, mucro only $\frac{1}{4}$ as long as hind claw. Manubrium : mucro-dens = 2 : $2\frac{1}{2}$. Clothing of scales distinctly marked with numerous short striations, apices obtusely pointed. Clavate ciliated setae on neck and thorax I. Antennae, furca, and legs with ciliated setae, a few outstanding ones on ant. II.

var. ANNULATA n. var.

Colour bluish-black with the pigmentation much lighter on anterior half of thorax III and abd. I–VI, giving the appearance of transverse stripes.

Co-types in the Cape Town Museum.

Localities :

f. principalis.—Rosebank, C.P., 22nd July 1930 (H. W.); Rondebosch, C.P., 29th July 1930 (H. W.).

v. annulata.—Kirstenbosch, C.P., 23rd July 1930.

Genus LEPIDOCYRTINUS Börner, 1903.

syn. = 1841, *Degeeria* Nicolet (ad partem).

1867, *Seira* Lubbock (ad partem).

1893, *Pseudosira* Schött (ad partem).

LEPIDOCYRTINUS INCERTUS Handschin, 1926.

A few specimens agreeing in coloration and morphological characters with this species, which was described by Handschin from Algeria, were found amongst the material collected by Dr. Barnard on Keurbooms River Estuary in Jan. 1931.

LEPIDOCYRTINUS PSEUDOCOERULEUS (Denis), 1924.

Sira pseudocoerulea Denis, 1924.

This species was described by Denis from material from Abyssinia in the Paris Museum. Specimens which appear to be referable to it have been found in South Africa as below. I can detect no difference in details between these specimens and the original description.

Kirstenbosch, C.P., 23rd July 1930 (H. W.); French Hoek, C.P., at 2000 feet, Dec. 1916 (K. H. B.); Hout Bay, C.P., Aug. 1930 (H. W.); Signal Hill, Cape Town, 31st Aug. 1930 (H. W.).

LEPIDOCYRTINUS COOPERI Handschin, 1929.

var. BARNARDI n. var.

(Text-fig. 10.)

This species is fairly common in the Cape Town neighbourhood, but all the specimens found differ constantly from the typical form



TEXT-FIG. 10.—*Lepidocyrtinus cooperi* Hand. v. *barnardi* v. n.

in the colour markings. The dark pigmentation on abdomen II of *L. cooperi*, instead of forming a complete band, is only present laterally, while on abdomen IV the band is present as a medial irregular transverse streak, and there is a posterior lateral spot on each side. In morphological details it fits very well into Handschin's diagnosis. I have great pleasure in associating Dr. Barnard's name with this form.

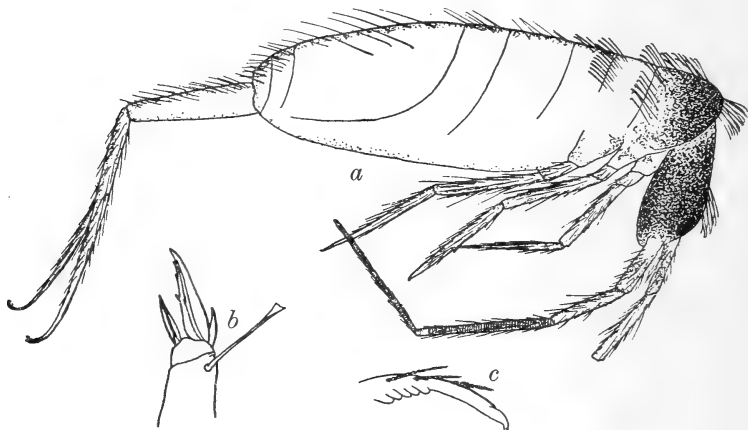
Co-types in the Cape Town Museum.

Localities.—Cape Town, 16th Dec. 1916; 1st Aug. 1915 at 1000 feet (K. H. B.); Kirstenbosch, C.P., 22nd July 1930 (H. W.).

LEPIDOCYRTINUS CAPENSIS n. sp.

(Text-fig. 11, a-c.)

Description.—Length 3 mm. Colour, yellowish ground with deep blue pigment on head, ant. I, th. II, and in darkest specimens laterally on abdominal segments. Eye patches black. Head bent vertically under thorax II. Antennae reaching beyond tip of

TEXT-FIG. 11.—*Lepidocyrtinus capensis* n. sp.

abdomen, I two-thirds length of head, segments I : II : III : IV = 2 : 3 : 4 : $3\frac{1}{2}$, III and IV distinctly annulated, IV with apical reversible knob. Head : th. II : III : abd. I : II : III : IV : V : VI = 3 : $2\frac{1}{2}$: $1\frac{1}{2}$: $1\frac{1}{4}$: $1\frac{1}{2}$: $1\frac{1}{2}$: 6 : $\frac{2}{3}$: $\frac{1}{2}$. Eyes 8 on each side.

Furca long; manubrium : mucrodens = 4 : 6, mucro falciform without basal spine, unannulated portions of dens 3 times as long as mucro, mucro one-third as long as hind claw. Claw with basal pair of inner teeth and 2 distal inner teeth, and a pair of strong outer lateral teeth the tips of which almost reach the level of paired inner teeth. Empodial appendage lanceolate, broad, simple, reaching beyond paired inner teeth of claw. Spatulate tibial hair long. Clothing of hairs and scales typical of the genus.

Co-types in the Cape Town Museum.

This interesting species, which in coloration is intermediate between *L. lesnei* Denis from Algeria and *L. semicoloratus* Handschin from Mexico, was taken in small numbers by Dr. Barnard on Matroosberg (Ceres side, Farm Laken Vallei), C.P., at 3500 feet in Jan. 1917.

LEPIDOCYRTINUS FLAVOVIRENS Börner, 1903.

This species was described by Börner (1903) from Nyassa under the name of *Lepidocyrtus flavovirens*. Specimens from the following localities may be referred to it:—

French Hoek, C.P., at 2000 feet, Dec. 1916 (K. H. B.); Matroosberg (Ceres side, Farm Laken Vallei), at 3500 feet, Jan. 1917 (K. H. B.); Hout Bay, C.P., Aug. 1930 (H. W.).

var. ANNULOSA Wahlgren, 1906.

Specimens agreeing in their entirety with the descriptions of Börner, Wahlgren, and later Denis (1924), were taken among shore herbage at Muizenberg, C.P., 25th July 1930 (H. W.).

LEPIDOCYRTUS ANNULIPES Handschin, 1929.

The original description of this species is anything but satisfactory, especially for a member of what is perhaps one of the most difficult groups of the Collembola. Except for size and coloration of antennae, the description would just as well fit the previous species. In particular the length of the antennae is not given, nor are any proportions of the antennal segments. It is therefore with some hesitation that the specimens from the two following localities are referred to *L. annulipes*. Additional details of the specimens are:

Length 4.5 mm. Colour as described by Handschin. Antennae three-fourths of body length; segments I : II : III : IV = 16 : 30 : 40 : 30; III and IV annulated; I and II together one-third as long again as the head. Thorax II twice as long as III. Abd. IV : III = 5 : 1½.

Localities.—Inchanga, Natal, Nov. 1917 (K. H. B.); Keeromberg, Worcester Mts., C.P., 3500 feet, Sept. 1930 (K. H. B.).

Specimens from the following localities are still more uncertain, but as the determination of this group of species, comprising *L. annulicornis* Börner, *voeltzkowi* B., *laeta* B., *aethiopica* Den., and *annulipes* Handschin is such a difficult and unsatisfactory business, I must be content to refer them dubiously to Handschin's species. These other localities are:

Great Winterhoek Mts., Tulbagh, C.P., Nov. 1916 (K. H. B.); Hottentots Holland Mts., C.P., Jan. 1916 (K. H. B.); Kloof Nek, Cape Town, 31st Aug. 1930 (H. W.); Stellenbosch, C.P., 29th Aug. 1930 (H. W.).

Family TOMOCERIDAE Börner, 1903.

NEOPHORELLA n. gen.

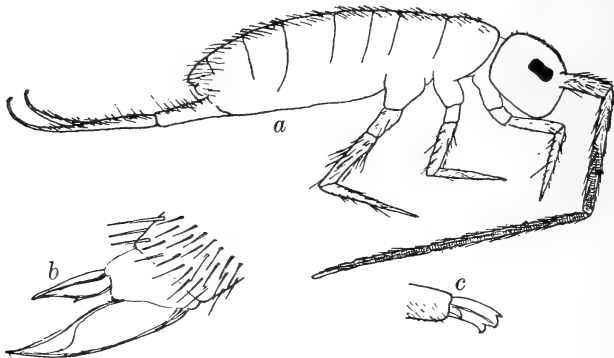
Description.—Abdomen III longer than IV, all abdominal tergites distinct. Without scales. Post-antennal organ absent. Ciliated sensory setae apparently absent from abdominal segments. Furca well developed. Dentes not distinctly annulated. Mucro small, of isotomurus type. No dental spines. Ant. III longer than IV, both annulated. Ocelli present. Tibial spur hair absent.

This genus connects the *Tomoceridae* with the *Isotomidae* in the structure of the mucro and the absence of scales, while in the other characters it is intermediate between the subfamilies *Lepidophorellinae* and *Tomocerinae* of the *Tomoceridae*.

NEOPHORELLA DUBIA n. sp.

(Text-fig. 12, a-e.)

Description.—Length 3.5 mm. Colour (in spirit) entirely yellow, except for the black eye patches and a small black spot between the



TEXT-FIG. 12.—*Neophorella dubia* n.g. n. sp.

antennae bases; apical segments of antennae slightly bluish. Eyes 8 on each side. ? Antennae slightly longer than body; segments I : II : III : IV = $1 : 2\frac{1}{3} : 2\frac{2}{3} : 2$; IV, III, and half of II distinctly annulated. Th. II : III = 4 : 3; abd. III : IV = $1\frac{1}{2} : 1$. Manubrium : mucrodens = 1 : 2. Claw long and strong without inner teeth, with inner groove which opens at about half-way (*cf.* fig.). Empodial appendage with broad inner and narrow outer lamella and a tooth at angle of inner lamella. Furca long and dentes not distinctly annulated. Mucro with 4 teeth as in *Isotomurus palustris* Müll.

Tibiotarsal spur hair absent. Mucro $\frac{1}{3}$ as long as hind claw. Clothing of fine simple setae of uniform length and no outstanding setae.

Locality.—Table Mt., Cape Town, at 2500 feet, 12th Sept. 1913 (K. H. B.), 1 spec.

The special features of this very interesting form have been discussed under the description of the genus.

Family CYPHODERIDAE Börner, 1913.

Genus CYPHODERUS Nicolet, 1841.

CYPHODERUS NATALENSIS Börner, 1913.

Localities.—In ants nests, Table Mt., Cape Town, 27th July 1930 (H. W.); in ants nests, Hout Bay, C.P., Aug. 1930 (H. W.).

CYPHODERUS ARCUATUS Wahlgren, 1903.

var. AETHIOPICUS Handschin, 1929.

Specimens agreeing with Handschin's variety of Wahlgren's species were obtained in small numbers in the inner recesses of the Congo Caves, Oudtshoorn, Nov. 1929, by Dr. Barnard.

On the genus *Lepidocyrtoides* Schött.

In his work on the Australian Collembola ("Results of Dr. Mjöberg's Swedish Sci. Exp. to Australia," Arkiv. f. zool., 1917), Dr. Schött erected the genus *Lepidocyrtoides* for certain tropical species of the older genus *Lepidocyrtus* as follows: "Tropischer Formen mit deutlich bis gar nicht hervorragenden Mesonotum, langen Antennen mit retractilen Sinneskolben am Ant. IV und deutlich längegestreiften Schuppen von verschiedener Form." He recognised at the time, however, that the forms which he placed under *Lepidocyrtoides* were rather a heterogeneous assemblage. In 1925 ("Collembola from Northern Sarawak," Sarawak Museum Journal) he again discusses these forms and removes *L. sagmarius*, *australicus*, *coeruleus*, and *cinctus* from *Lepidocyrtoides* to a new genus *Lepidosira*. He particularly states here, that he wishes to keep *L. cucularis* as the type of the *Lepidocyrtoides* (obviously misprinted *Lepidocyrtus*). He separates these two genera mainly on the form; those having the mesonotum not overhanging he places in *Lepidosira*.

I have been working now for some time on a considerable amount of Australian material, and I have found that as so far suggested by

Schött his classification works very well. Unfortunately, however, in 1927 in a second paper on the Collembola of the Cameroons (Kamerunische Collembolen. Linköping) he again reopens the question, and on p. 16 he diagnoses afresh the genus *Lepidocyrtoides*. He now gives the main characters as "Tibien ungegliedert, Endkolben am Ant. IV. nicht vorhanden." This is obviously quite the opposite of his original diagnosis and would not allow of *L. cucularis* being kept as the genotype. Furthermore, these characters are essentially those of *Lepidocyrtus* s. str. On the basis of this newer diagnosis he removes his Cameroon species *L. ferrugineus* and *maximus* from *Lepidocyrtus*, where he had originally placed them to *Lepidocyrtoides*.

Apart from the validity of his second diagnosis, it seems to me that his more recent classification is impracticable and but serves to make what is at the best a difficult study, only more difficult. In this paper I retain his older views and include his species from the Cameroons in the genus *Lepidocyrtus* s. str. From this it follows that *Lepidocyrtoides* is not an African genus, but is confined to Australasia.

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EXPLANATION OF TEXT-FIGURES.

- TEXT-FIG. 1.—*Hypogastrura armata* (Nic.). Anal spines of aberrant specimen.
- TEXT-FIG. 2.—*Polyacanthella barnardi* n. sp. (a) Eye patch; (b) hind tibiotarsus and claw; (c) dens and mucro; (d) anal segment and spines from above.
- TEXT-FIG. 3.—*Brachystomella capitata* n. sp. (a) Anterior ocelli and post-antennal organ; (b) head of maxillae; (c) antennal organ III; (d) hind tibiotarsus and claw; (e) anal segments.
- TEXT-FIG. 4.—*Achorutes natalensis* n. sp. (a) Antenna; (b) head tubercle showing ocelli; (c) claw.
- TEXT-FIG. 5.—*Isotoma mossopi* n. sp. (a) Ocelli and post-antennal organ; (b) hind claw; (c) tip of dens and mucro.
- TEXT-FIG. 6.—*Vertagopus minos* Denis. (a) Male; (b) female; (c) anterior ocelli and post-antennal organ; (d) hind foot; (e) mucro; (f) dorsal seta of posterior segments; (g) lateral seta of dorsal segments.
- TEXT-FIG. 7.—*Proisotoma africana* n. sp. (a) Ocelli and post-antennal organ; (b) hind claw; (c) dens and mucro.
- TEXT-FIG. 8.—*Entomobrya decemfasciata* Packard, Handschin. (a) Dorsal view, after Handschin; (b) lateral view, after Handschin; (c) hind claw.
- TEXT-FIG. 9.—*Pseudosira grisea* n. sp. (a) Entire insect; (b) tip of antenna IV; (c) foot; (d) tip of dens and mucro; (e) body scale.
- TEXT-FIG. 10.—*Lepidocyrtinus cooperi* Handschin var. *barnardi* v. nov.
- TEXT-FIG. 11.—*Lepidocyrtinus capensis* n. sp. (a) Lateral view; (b) foot; (c) tip of dens and mucro.
- TEXT-FIG. 12.—*Neophorella dubia* n. gen., n. sp. (a) Entire insect from side; (b) claw and tip of tibiotarsus; (c) mucro.



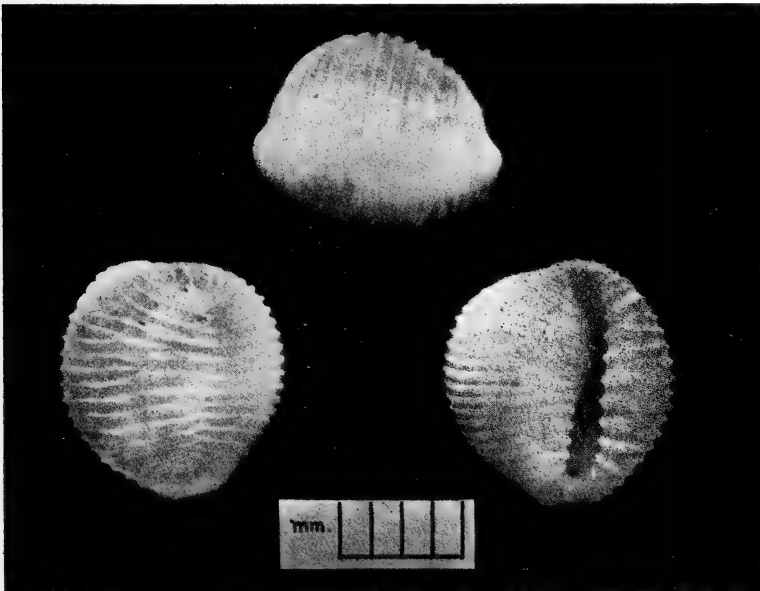
15. *Reports on the Marine Mollusca in the Collections of the South African Museum.* By J. R. LE B. TOMLIN, M.A., and Dr. F. A. SCHILDER.

(With 3 Text-figures.)

IX. FAMILY TRIVIIDAE.

Triviella splendidissima n. sp.

SHELL white, subpellucid, iridescent, the spire and extremities being slightly tinged with yellow; shape very globular, outer lip very



A. E. Salisbury, photo.]

FIG. 1.—*Triviella splendidissima* n. sp.

tumid, margined, left border regularly convex; spire entirely hidden, hardly visible through the subpellucid enamel; there is no dorsal sulcus though some ribs alternate on the dorsum; interstices quite smooth without trace of granulation dorsally; aperture narrow, straight, rather central; anterior outlet rather narrow, semicircular,

posterior outlet obsolete, hardly marked; ribs rather distant dorsally, interstices nearly as large, labial teeth very distant; columellar ribs close, slightly flattened, interstices half as broad; interstices of the ribs on the outer lip longitudinally corrugate; anterior termination of the inner lip hardly projecting at all; columellar sulcus absent posteriorly, but the columellar ribs pass over the columella for some

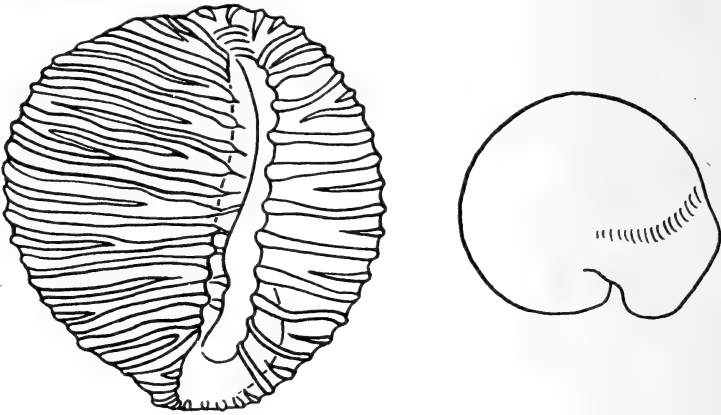


FIG. 2.

Triviella splendidissima n. sp. Ventral view.

Outlines of the shell. View from the apex (from behind).

distance; edge between base and columella distinctly marked; fossula rather broad but very steep and very slightly concave, inner border slightly projecting with two feeble denticles.

Length 7.8 mm., breadth 7.3 mm., altitude 6.2 mm.

Number of labial teeth, 12.

Number of columellar teeth, 14.

Number of ribs round the shell 58, while 12 ribs cross the dorsum.

Hab.—One living example dredged off Cape Morgan in 77 fathoms (S.A. Mus., A3534).

This species is in some ways intermediate between *Trivia* and *Triviella*; the latter genus was founded by Jousseaume* in 1884 with the well-known South African *Cypraea oniscus* Lamarck as type. We assign our new species to *Triviella* on account of the coarse labial teeth and the characters of the fossula, the posterior outlet and the columella. The narrowness of the aperture (caused by the thickening of the lip) and its angular left border are more as in *Trivia*, though the latter character is noticeable also in *costata* Gmelin, which is certainly a *Triviella*.

* Bull. Soc. Zool. France, ix, p. 99.

Our new species has no connection with *Trivia suavis* Schilder (= *formosa* Gaskoin non Gray), another South African species.

The thickened outer lip and very slight indications of callosities above both extremities are quite similar superficially to *Trivia hamburgensis* Schilder * from the Miocene of Northern Germany, and are caused by similarity of habitat.

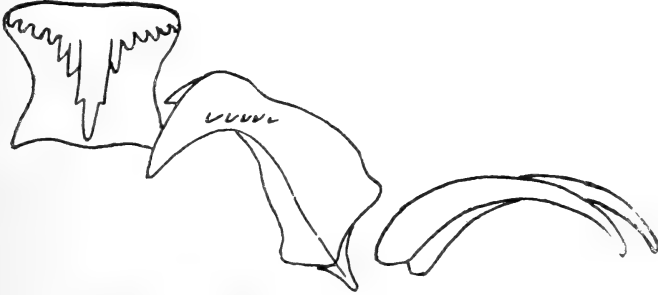


FIG. 3.—*Triviella splendidissima*, n. sp. Central, lateral, and marginal teeth of radula. $\times 400$.

Lt.-Col. Peile succeeded in extracting the dried animal and in mounting the radula, and from a drawing which he has very kindly provided we are able to illustrate the central, lateral, and marginal teeth.

The radula consists of 33 rows + nascent with the usual taenioglossate formula 2.1.1.1.2.

Fragments of the jaws resemble in structure those of *Trivia coccinella* (Lamarck), as figured by Troschel in *Das Gebiss der Schnecken*, vol. i, pl. xviii, f. 3.

* Mitt. Min. Geol. Staatsinstitut Hamburg, pt. xi, p. 13, text-fig. 6, a-d, 1929.



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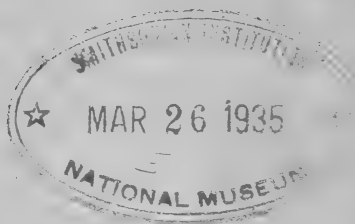
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PART IV, containing :—

16. *The Staphylinid Fauna of South Africa.* (Thirty-third Contribution to the African Fauna.) By Dr. MAX BERNHAUER, Horn, Nied. Oesterreich. (Translated from the German manuscript.) (With Plate XIV.)
17. *South African Stone-flies (Perlaria), with Descriptions of New Species.* By K. H. BARNARD, D.Sc., F.L.S. (With 21 Text-figures.)
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16. *The Staphylinid Fauna of South Africa.* (Thirty-third Contribution to the African Fauna.)—By Dr. MAX BERNHAUER, Horn, Nied. Oesterreich.

(Translated from the German MS.)

(With Plate XIV.)

THROUGH Sir Guy A. K. Marshall and Dr. G. Arrow, the British Museum in London has kindly submitted to me for study their material collected in the Cape Province, Orange Free State, Natal, South West Africa, and Rhodesia, for which material I here express to these gentlemen my warmest thanks.

I am describing below the new species in this material, and am also including some new ones obtained by English collectors in the Belgian Congo.

The types of the new species described below are in the collections of the British Museum and in my own.

The most interesting fact is the discovery of a representative of a new tribe, which I describe as follows:—

Eparchiini n. Trib.

This tribe is intermediate between the *Omaliini* and the *Oxytelini*. From the *Omaliini* it differs by the absence of ocelli and the non-carinate base of the venter; from the *Oxytelini* by the absence of a ventral costate edge on the second abdominal segment and by the strongly developed trochanters of the hind legs, which are a third of the length of the hind femora, or slightly longer. The prosternum is narrow; the front coxae are large, conical, strongly produced. Epimera of the prosternum as well as exposed spiracles are entirely absent.

Eparchium n. g.

Body moderately short, with broadened abdomen, moderately densely clothed with fine, long, black hairs. Head strongly elongated, much longer than broad, parallel-sided, narrow, scarcely constricted behind, with very large, very dorsally situated eyes, with the temples

unmargined below, much longer than the longitudinal diameter of the eyes seen from above, with two long, deep, punctured and posteriorly slightly convergent grooves in front, at the posterior end of which there is a larger puncture; antennae moderately long, slightly thickened towards the apex, the third joint a little longer than the second, the following ones scarcely longer than broad, the eleventh shorter than the two preceding ones combined; anterior margin of labrum slightly rounded; mandibles short and broad, both un-toothed; maxillary lobes short, the inner one at the apex with long hairs towards its apex, the outer one slightly broadened towards the apex, membranous along the inner margin and with dense and long hairs; maxillary palps short, the basal joints broader than long, the terminal joint as long as the two preceding ones together; labium broad, undivided, with the anterior margin rounded, labial palps almost of the same shape as the maxillary palps. Thorax oblong, almost cylindrical, deeply and broadly transversely depressed before the anterior margin; the epipleurae slightly visible from a lateral view. Elytra much shorter than the thorax, strongly broadened posteriorly, conjointly emarginate posteriorly, each rounded off at the suture as in the case of *Thinobius*. Abdomen broadened posteriorly, with narrow lateral margins. Mesosternum short, the middle coxae touching. The legs moderately slender; the tibiae without spines; tarsi all five-jointed, with the first four joints of the front tarsi short, the last one almost as long as the preceding ones together, with the first joint of the middle tarsi scarcely longer than the second, the last joint of the much more slender hind tarsi much longer than the second; this and the following ones elongated, the last joint being shorter than the two preceding ones together.

Nothing is known of the habits of this interesting insect.

Genotype.—*E. paradoxum* n. sp.

Eparchium paradoxum n. sp.

(Plate XIV.)

Deep black, sometimes with an indistinct, or even entirely absent, large, bright, reddish-yellow spot in the middle of the two first exposed tergites; the antennae, palps, tarsi, anterior tibiae, and also parts of the other tibiae yellowish. The head is much narrower than the thorax, with slightly rounded posterior angles, with two large transverse punctures on the disk above, fairly smooth, very sparsely punctured, though more densely punctured before the base and

especially behind the eyes. The thorax is as broad as the elytra across the shoulders, imperceptibly narrowed posteriorly, sparsely and finely punctured, shining, more visibly punctured in the broad transverse depression. The elytra are moderately densely and finely punctured, densely covered with yellowish hairs and slightly shining. Abdomen fairly strongly and densely, distinctly coarsely punctured and with dense yellowish hairs, moderately shining. Length 2.5-3 mm.

Cape Province: Matjiesfontein (22nd-23rd October 1928); Worcester (September 1928) (R. E. Turner).

Gen. *Lispinus* Er.

Revision of the species at present known from South Africa.

1. Body large, narrow, elongated; thorax as long as broad. Length 6 mm.
aciculatus Bernh.
- Body smaller, under 4 mm., less narrow, shorter; thorax considerably broader than long 2.
2. Elytra considerably longer than the thorax 3.
- Elytra not or only slightly longer than the thorax 6.
3. Coloured black 4.
- Coloured reddish-yellow to rusty-red 5.
4. Thorax and elytra convex, strongly shining *natalensis* Bernh.
- Thorax and elytra flatter, dull *capensis* Bernh.
5. Rusty-red, convex, narrower; front part of body strongly and fairly densely punctured; thorax approximately one-fourth broader than long, an integumentary sculpture scarcely visible even under fairly strong magnification; elytra about one-fourth longer than the thorax, sometimes also shorter, strongly and fairly densely and rugosely punctured, the ground puncturation being very fine, scarcely visibly shagreened, shining. Length 2.8-3 mm. Pondoland: Port St. Johns (October 1923-April 1924); Zululand: Eshowe (April 1924); Natal: Kloof, 1500 feet (September 1926) (R. E. Turner)
pondoënsis n. sp.
- Reddish-yellow, fairly plain; front part of body fine and moderately densely punctured, the ground puncturation very fine, but very distinctly shagreened; thorax nearly one-third broader than long; elytra nearly a third longer than the thorax, exceptionally finely and sparsely punctured, the longitudinal ground striation exceptionally dense and very distinct, dull. Length 3-3.1 mm. N.W. Rhodesia: Mwengwa (27° 40' E., 13° S.) (26th June 1913); Shigariatombwes (8th June 1913) (H. C. Dollman) . . . *dollmani* n. sp.
6. Elytra distinctly a little longer than the thorax, quadrate, not broader than long, rugosely punctured all over, with numerous fine superimposed punctures, slightly yet distinctly shining; thorax scarcely broader than the elytra, moderately broader than long; rusty-red; front part of body with fine and separated punctures, moderately shining; abdomen indistinctly and sparsely punctured. Length 2.8 mm. Zululand: Eshowe (R. E. Turner)
rugulipennis n. sp.

6. Elytra as long as the thorax, shorter than breadth of both combined, only indistinctly longitudinally striate along the suture, exceptionally densely and coarsely sculptured, not shining, longitudinally distinctly and fairly strongly rugulose punctured towards the sides; thorax distinctly a little broader than the elytra, approximately one-fourth broader than long; for the rest very similar. Length 2.8 mm. Pondoland (15th-31st August 1923) (R. E. Turner) *paradozus* n. sp.

Lispinodes rhodesianus n. sp.

Differing from *Lispinodes africanus* Bernh., to which it is nearly related, by the longer thorax, longer elytra, and entirely dull upper surface.

Rusty-red, dull; the head and abdomen a little darker, sometimes also the elytra are darkened; antennae, palps, and legs reddish-yellow. Head about as broad as the thorax, moderately rounded, exceptionally finely shagreened and very finely and sparsely punctured; antennae short, the penultimate joints strongly transverse. Thorax a little narrower than the elytra, as long as broad, narrowed posteriorly, flattened and plain, sculptured like the head. Elytra narrow, about twice as long as the thorax, about half as long again as their combined breadth, scarcely more strongly punctured but with the punctures a little more separated, dully shagreened. Abdomen dully shagreened. Length 2-2.5 mm.

N.W. Rhodesia: Shigariatombwes (8th August 1913) (H. C. Dollman).

This species also occurs in the Belgian Congo: Elizabethville (6th October 1912) (*congoënsis* Bernh. i. 1).

Phloeonomus ruficollis n. sp.

Distinguished by the small size, colour, and sparse puncturation. Black, shining; the thorax reddish-yellow, partly brownish; the head and elytra pitch-brown; bases of the brownish antennae, the palps, and the legs pale yellowish. Head is half as broad as the thorax, transverse, shining, with few strong punctures, anteriorly with one longitudinal depression above the bases of antennae; antennae short, the last 6 joints dark, forming a well-marked-off club. Thorax a little narrower than the elytra, about a third broader than long, the sides strongly rounded, strongly narrowed anteriorly, very convex, very shining, scarcely punctured. Elytra nearly twice as long as the thorax, distinctly broadened posteriorly, shining, with

some rows of coarse punctures which disappear posteriorly. Abdomen fairly shining, not distinctly punctured. Length 1.3–1.5 mm.

Cape Province: Montagu (23rd–30th September 1914); Worcester (September 1928) (R. E. Turner).

Phloeonomus caffer n. sp.

Clearly distinguished from the preceding species by the larger size and more elongated shape, the colour, longer elytra, and denser sculpture.

Black, moderately shining; thorax dark reddish-brown; elytra, antennae, palps, and legs pale reddish-yellow. Head exceptionally finely shagreened, with very fine and separated punctures, slightly shining. Thorax a little narrower than the elytra, nearly half as broad again as long, rounded on the sides, moderately narrowed anteriorly, moderately convex, with the punctures very fine and not very scattered and superimposed upon an exceptionally fine shagreen, yet fairly shining. Elytra twice as long as the thorax or slightly longer, strongly and densely punctured, fairly shining. Abdomen shining, scarcely punctured. Length 1.8 mm.

Pondoland: Port St. Johns (5th–30th April 1923) (R. E. Turner).

Phloeonomus turneri n. sp.

Closely related to *caffer*, separated from it by the much larger and broader form and by the following additional points:—

Head more shining, apart from the shagreen scarcely punctured. Thorax slightly less short, the sides more strongly narrowed anteriorly, with a feeble longitudinal depression on each side of the middle part, more strongly and very acutely but not densely punctured, strongly shining notwithstanding the ground sculpture. Elytra are less strongly and more densely punctured, slightly shorter in relation to the thorax. Coloured pitch-black, the thorax more brown, the elytra reddish-yellow, the entire antennae, palps, and legs bright pale yellow. The joints of the antennal club exceptionally short, at least three times broader than long. Length 2 mm.

Pondoland: Port St. Johns (5th–30th April 1923) (R. E. Turner).

Trogophloeus (Carpalimus) capensis n. sp.

To be placed very near *arcuatus* Steph., separated from it and allied forms by the much shorter and broader thorax and shorter elytra.

Black, densely grey-haired; the first antennal joint and the legs reddish-yellow. Head considerably narrower than the thorax, with very fine and dense hairs, with very large bulging eyes and scarcely indicated temples; antennae fairly long, the penultimate joints distinctly transverse. Thorax moderately narrower than the elytra, nearly half as broad again as long, strongly narrowed posteriorly, with a deep and broad, crescent-shaped, transverse depression before the base, in front of which there is only a very feeble indication of two shallow impressions, with exceptionally fine, scarcely visible, and dense puncturation. Elytra a little broader than long, very finely and very densely punctured, with a very feeble small impression on each side behind the scutellum. Abdomen with shagreen-like punctures, dull. Length 2.6 mm.

Pondoland: Port St. Johns (7th-13th August 1923) (R. E. Turner).

Trogophloeus (Taenodema) punctiger n. sp.

Resembling *impressus* Lac. very closely in form, separated at once by the smaller eyes, much longer and strongly prominent temples, shorter thorax, and much more scattered puncturation on the thorax and elytra.

Black, fairly shining; the first and last joints of the otherwise black antennae and the legs reddish-yellow; the thorax and elytra brownish. Head a little narrower than the thorax, with two strong frontal grooves, very finely and densely punctured; eyes moderately large; temples well developed, half as long as the longitudinal diameter of the eyes, projecting cheek-like; antennae short, the penultimate joints transverse. Thorax much narrower than the elytra, about a third as broad again as long, strongly rounded and narrowed posteriorly, with two strong longitudinal grooves before the scutellum, with another strong longitudinal impression near the lateral margin, with moderately fine and not very dense puncturation, shining. Elytra considerably larger than the thorax, nearly as long as their combined breadth, with strongly prominent shoulders, fairly strongly and not very densely punctured, shining. Abdomen with shagreen-like sculpture, dull. Length 2 mm.

N.W. Rhodesia: Namwala (30th March 1913) (H. C. Dollman).

Trogophloeus (Taenosoma) parcepunctatus n. sp.

Separated from the closely related *foveolatus* Sahlb., with which this new species shares an entirely non-shining anterior part of the body, by the following points:—

The head is coarsely rugulose punctured; the temples are a little longer; the antennae less dark, with the first joint bright yellowish-red. Thorax likewise with much stronger, coarsely rugulose, but just as dense puncturation, without a depression, entirely plain. Elytra a little shorter, with the punctures a little stronger and distinctly more scattered. Legs reddish-yellow. Length 1.5 mm.

Natal: Kloof, 1500 feet (September 1926) (R. E. Turner).

Anisopsis carinata Fauv., var. *rugulipennis* n.

Separated from *Anisopsis carinata* Fauv., though scarcely specifically, by the different colour.

Deep black; a large triangular spot at the posterior angles of the elytra reddish-yellow; the first five antennal joints, the palps, and the legs dirty reddish. Length 3.2 mm.

Natal: Drakensberg, Van Reenen (November 1926) (R. E. Turner).

Oxytelus (s. str.) *crenulicollis* n. sp.

Closely resembles *O. crenaticollis* Fauv.; differs in being larger, partly paler coloured, and in the following additional characters:—

Head considerably broader, only slightly narrower than thorax in ♂, more strongly transverse, the longitudinal striation near the eyes nearly twice as dense. Thorax is similarly shaped, a little more densely sculptured, however, on the sides. Elytra are much more finely punctured, and also along the inner half punctato-striate, whereas in *crenaticollis* they are all over finely aciculary punctured. Eyes are considerably larger; the temples smaller, in ♂ not longer than the longitudinal diameter of the eyes seen from above, whereas in *crenaticollis* the diameter is considerably shorter than the temples, to where they curve. The colour is pitch-black, the head and thorax being often paler, the elytra whitish-yellow, the abdomen partly yellowish, the antennae entirely reddish-yellow, the palps and the entire legs paler reddish-yellow. Length 4.5–5.5 mm.

N.W. Rhodesia: Mwingwa (27° 40' E., 13° S.) (18th March 1914) (H. C. Dollman).

Oxytelus (Tanyraerus) incognitus n. sp.

Strikingly like *O. laqueatus* Marsh. in shape, size, and colour, but separated by the following characters:—

The head is smaller and longer, exceptionally dully shagreened in front, not shining, slightly less strongly and more densely longitudinally striated posteriorly, little shining; antennae longer, the penultimate joints less transverse. Thorax is a little less broad, more strongly and sinuously narrower, considerably more densely punctured; the central furrow is not uninterrupted and deep as in *laqueatus*, but interrupted in the middle, the lateral ones a little more deeply impressed. Elytra are very similar, but more striato-punctate. Length 4.5 mm.

Cape Province: Cape Town; Table Mountain (1906) (W. Bevins).

Oxytelus (Tanyraerus) aluticeps n. sp.

This species is very near *O. grandis* Epp., which appears not to be uncommon in the Congo region, in having the same shape and colour, but is distinguished from it by the entirely different sculpture on the head and in being by a good half smaller.

Black, shining; the thorax pitch-brown; the elytra, the bases of the otherwise brownish antennae, the mouth, and the legs bright reddish-yellow; the base of the abdomen dirty yellowish in part. The head is shorter, not shining, and simply punctured all over as in *grandis*, but dull striately shagreened, only the anterior part and the extreme base being shining. Thorax distinctly shorter, nearly more than half as broad again as long, distinctly impressed on the sides, without any indication of lateral grooves next to the distinct central furrow, with the punctures a little finer and perhaps more scattered. Elytra distinctly longer than the thorax, with the punctures fine and nearly in rows. Length 4 mm.

Belgian Congo: 18 miles S.W. of Elizabethville (1928) (H. S. Evans).

Oxytelus (Tanyraerus) turneri n. sp.

Separated at once from the closely related *O. micans* Kr. by the different colour, larger and broader body, and the head, which even in ♀ is broadened posteriorly, much more shining, and not shagreened anteriorly.

Deep black; the legs dark pitchy. Head as broad as thorax in ♂, narrower than thorax in ♀, more strongly broadened in ♂, less strongly

in ♀, shining, with two feeble longitudinal grooves transversely depressed behind these, punctured finely and not very densely, anteriorly sparsely, more strongly laterally; eyes with very fine facets; temples well developed; antennae short, strongly thickened and club-like towards the apex, the penultimate joints more than twice as broad as long, the last joint large and longer than the two preceding ones together. Thorax is slightly less short than in *micans* Kr., the sides less rounded, broadly depressed near sides, with the three centre grooves much less deeply and less strongly depressed, with the puncturation denser. Elytra are more densely and strongly longitudinally striated. Abdomen with very fine and scattered punctures. Length 2.5–3 mm.

Natal: Drakensberg; Van Reenen (November 1926) (R. E. Turner).

Oxytelus (Tanykraerus) okahandjanus n. sp.

Also belonging to the *micans* Kr. group, distinguished by the long elytra.

♀.—Black, shining; the elytra brownish; the bases of the rusty-brown antennae, the palps, and legs dirty yellow. Head much narrower than the thorax, feebly rounded posteriorly, with the grooves on vertex not very deep, with fine and scattered punctures, shining, with few stronger punctures; temples shorter than the longitudinal diameter of the eyes; antennae less short than in the previous species, otherwise very similarly shaped, the penultimate joints scarcely twice as broad as long. Thorax a little narrower than the elytra, about a third broader than long, the sides gently rounded, with a broad, shallow depression near the sides, with the central groove not very strong and without distinct lateral grooves, with fine and scattered puncturation. Elytra about one-third longer than the thorax, finely and not very densely punctato-striate. Length 2.8 mm.

S.W. Africa: Okahandja (3rd–11th December 1927) (R. E. Turner).

Oxytelus fulgidus Fauv., var *claripennis* n.

Distinguished from the uniformly coloured typical form only by the bright yellow elytra.

Cape Province: Aliwal North (December 1922). Orange Free State: Harrismith (March 1927) (R. E. Turner). Natal: Van Reenen. Rhodesia: Salisbury (G. A. K. Marshall).

Oxytelus (Tanyraerus) punctus n. sp.

Distinguished among the species with only one distinct thoracic groove by the dense and strong puncturation on the front part of body.

♀.—Brownish-yellow to reddish-yellow; the head darker; the thorax reddish-brown to yellowish-red; the elytra uniformly coloured or with the base reddish; the entire antennae, the mouth, and the legs reddish-yellow. Head narrower than the thorax, with the puncturation strong and dense, longitudinally rugulose posteriorly and fine and scattered near front margin, shining; grooves on the vertex scarcely evident; temples well developed, half as long as the longitudinal diameter of the very finely faceted eyes, shortly rounded posteriorly; antennae moderately short, fairly equally broad from the fifth joint, the penultimate joints about half as broad again as long, the terminal joint a little longer than the two preceding ones together. Thorax a little narrower than the elytra, about a third broader than long, broadest in first third, distinctly somewhat roundly narrowed posteriorly, shallowly depressed near the lateral margin, with a fairly fine central groove in the middle, with only a very feeble indication of lateral grooves, strongly and densely, fairly uniformly punctured, shining. Elytra a little longer than the thorax, with dense and longitudinally rugulose puncturation. Abdomen with exceptionally fine and sparse puncturation and dully shagreened. Length 3.5 mm.

Belgian Congo: 18 miles S.W. of Elizabethville (1928) (H. E. Evans).

Oxytelus (Tanyraerus) rufulus n. sp.

Very closely related to *O. planus* Fauv., from which it is separated by the slightly broader and shorter head, larger eyes, shorter temples, but especially by the much stronger and denser puncturation on the thorax and by the colour.

Uniformly rusty-red, with paler antennae, palps, and legs. Head almost as broad as thorax in ♂, narrower than the thorax in ♀, almost unpunctured, with fairly large eyes; temples only about half as long as the longitudinal diameter of the eyes; antennae only moderately thickened towards the apex, the penultimate joints only about half as broad again as long. Thorax strongly convex, approximately about one-third broader than long, fairly strongly, distinctly a little roundly, narrowed posteriorly, with bluntly rounded posterior angles, moderately fine and fairly densely punctured, almost without indica-

tions of grooves or impressions, shining. Elytra scarcely as long as the thorax, very finely and sparsely punctured, shining, with a very feeble indication of a longitudinal depression. Abdomen with only a few punctures, shining smooth. Length 2.5 mm.

Mashonaland: Salisbury (1910) (G. A. K. Marshall).

Oxytelus (Anotylus) mortuorum n. sp.

Belongs to the *inustus* Grav. group, but easily separated by the deep black colour and the very dense longitudinally rugose sculpture on the thorax.

Deep black, fairly shining; the mouth and the femora pitchy; the tibiae and tarsi bright reddish-yellow. Body moderately broader and more compact. Head almost as broad as the thorax in ♂, considerably narrower than the thorax in ♀, with dense longitudinally rugose puncturation, smooth and shining anteriorly; eyes not very prominent, finely faceted; temples well developed, a little shorter in ♂, much shorter in ♀, than longitudinal diameter of eyes; antennae short, gradually thickened towards the apex, the penultimate joints slightly more than half as broad again as long, the terminal joint as long as the two preceding ones together. Thorax a little narrower than the elytra, about half as broad again as long, the sides feebly and fairly uniformly rounded, without an impression near the sides, discally with a distinct central groove but scarcely indicated lateral grooves, with very dense costate-rugae all over, a little shining. Elytra as long as the thorax, together strongly transverse, longitudinally rugose like the thorax, the rugae, however, finer and denser. Abdomen exceptionally finely shagreened, scarcely visibly punctured. Length 2.5 mm.

Belgian Congo: 18 miles S.W. of Elizabethville (1928) (H. S. Evans).

Oxytelus (Anotylus) mashonensis n. sp.

A small, rather insignificant species of the *inustus* group, distinguished by the sparse puncturation on the front part of the body, especially the almost unpunctured head.

Black, shining; the elytra, the bases of the antennae, and the legs pale reddish-yellow; the mouth rusty-red. Head narrower than the thorax, depressed in the middle, with two fine frontal grooves and a small depression on the vertex, shining, scarcely punctured; eyes not very prominent, their longitudinal diameter, seen from above, much longer than the short temples; antennae of the normal shape,

the penultimate joints almost twice as broad as long. Thorax almost half as broad again as long, a little narrower than the elytra, the sides slightly rounded, with bluntly rounded posterior angles, with a broad, deep depression near the sides, centrally with a deep longitudinal groove, slightly interrupted before the middle, with a less strong and shortened lateral groove on each side, the puncturation fine and sparse, more strongly and densely on the inside of lateral depressions. Elytra a little longer than the thorax, with a longitudinal depression, with the puncturation fine and scattered, scarcely longitudinally rugose. Abdomen indistinctly punctured, shining. Length 2.5 mm.

Mashonaland: Salisbury (1910) (G. A. K. Marshall).

Oxytelus (Anotylus) quadricarinatus n. sp.

Belonging to the *tetracarlinatus* group and easily distinguished from the rest of the African species by the faintly greasy-shining head, and especially by the four fine, shining carinae on the thorax.

Deep black, dull, the elytra slightly paler; the tibiae and tarsi yellowish. Head scarcely narrower than the thorax in ♂, in ♀ considerably narrower, transversely quadrate, exceptionally finely shagreened; antennal tubercles shining; the vertex with faint, greasy lustre; antennae fairly thickened towards apex, the penultimate joints a little less than twice as broad as long. Thorax about a third broader than long, the sides feebly rounded, dully shagreened, with four fine, not abbreviated, shining carinae, of which the two inner ones are very near together and enclose the central groove, and the lateral ones are further removed, with a broader and stronger depression on each side between the lateral carinae and the side. Elytra much longer than the thorax, exceptionally finely striato-shagreened, dull, with small, sparsely scattered punctures. Anterior tibiae not crenate along the outer margin. In the ♂ the sixth sternite is inconspicuously emarginate. Length 1.5 mm.

Belgian Congo: 18 miles S.W. of Elizabethville (1928) (H. S. Evans).

Platysthetus natalensis n. sp.

Resembling *P. armatus* Sachs. deceptively in shape, size, and colour, and separated only by the less dense puncturation on the head, and especially on the elytra; possibly only a race of *armatus*.

The elytra are mostly very sparsely punctured, whereas they are comparatively densely punctured in *armatus*. The puncturation of

the head and thorax also is considerably more scattered. Apart from these, I can find no further essential differences. Length 2.8-3.5 mm.

Natal: Drakensberg; Van Reenen, 5500-6500 feet altitude (October 1926) (R. E. Turner).

Bledius (s. str.) *lamelliceps* n. sp.

Easily distinguished from *B. pilicollis* Bernh. (with which, among the African species, it shares a similar sexual distinction in the ♂) by the absence of the characteristic hair on the thorax, much shorter elytra, and the entirely different colour. From our endemic (European) species of the *tricornis* group, which it closely resembles in colour, it is distinguished by the shorter elytra, very scattered puncturation on the thorax, and other sexual distinctions in the ♂.

Deep black; the elytra dull blood-red; the legs pitchy; the hairs, excepting the few lateral bristles, sparse and short. Head exceptionally densely and strongly granularly shagreened, entirely non-shining, with a very large, broad, dorsally truncated and anteriorly strongly produced raised lobe on each side above the eyes in the ♂. Thorax broader than long, parallel-sided, with bluntly rounded posterior angles, distinctly and moderately densely granularly shagreened, moderately shining, with a stronger central groove medially, with moderately strong and scattered puncturation, with unpunctured areas behind the middle and laterally, medially produced anteriorly in the ♂ into a fairly short, triangular, apically much attenuated, spine-like, densely haired process. Elytra only a little longer than the thorax, with fine and scattered puncturation on an exceptionally finely, scarcely visibly, striated background, moderately shining. Abdomen dull, granularly shagreened, moderately finely and sparsely punctured. Length 5.5 mm.

Cape Town: Milnerton (February 1926) (R. E. Turner).

Bledius (*Blediodes*) *semiopacus* n. sp.

This species is very near *B. glasunovi* Luze. and differs from it only in the following points:—

The head and thorax are less dull, the latter more distinctly and densely punctured; antennae paler, reddish-yellow to near apex, whereas they are brownish in *glasunovi*. The most important difference is, however, found in the puncturation of the elytra, which are at least twice as strongly and half as densely punctured and

thus more shining. I can find no other essential differences. The two species may be confused even by their similarity in colour and shape.

From *atricapillus* Germ. the new species differs essentially by the duller, finer, and more scattered puncturation on the front part of the body, and by the stronger and more scattered puncturation on the elytra. Length 3.2 mm.

Natal: Frere; Estcourt (1910) (G. A. K. Marshall).

Bledius (Hesperophilus) lateripennis n. sp.

A species easily distinguished by the colour.

Black, fairly shining; a very large spot on the elytra, extending almost along the entire sides to about the first fifth and inwards to over the middle, the bases of the antennae, the legs, and the extreme apex of abdomen from the ninth tergite onwards yellowish-white; the mouth rusty-red. The head exceptionally finely and dull shagreened, entirely non-shining; antennae a little thickened towards apices, the penultimate joints fairly transverse. Thorax broader than long, parallel-sided, with rounded posterior angles, with a fine central groove, finely and moderately densely punctured, fairly shining. Elytra much longer than the thorax and much longer than the breadth of both combined, considerably more strongly and densely punctured than the thorax, fairly shining. Abdomen shining, fairly strongly and sparsely punctured. Length 2.5–3 mm.

Pondoland: Port St. Johns (October 1923) (R. E. Turner).

Bledius (Hesperophilus) pruinosulus n. sp.

Very close to *B. michaelsoni* Bernh. from South West Africa; very closely resembling it and scarcely distinguishable in sculpture, but apart from the uniform black or pitch-black colour, also distinguished by the following additional characters:—

The thorax is broader and much shorter, almost one-third broader than long, with a very narrow but distinct, smooth, shining line along the middle, with the sides straighter, the posterior angles less arcuately rounded. The elytra are much longer, almost half as long again as the thorax, without a reddish-yellow spot at the posterior angles, unicolorous, blackish, dirty brown in immature specimens, about one-fourth longer than their combined breadth. The mouth and legs pale yellow; the antennae a little darker. Length a little over 2 mm. (with the abdomen drawn in).

Mashonaland (December) (G. A. K. Marshall).

Bledius (subgen. n. *Pareiobledius*) *alutellus* n. sp.

The new subgenus differs from *Hesperophilus* (with which it agrees in the very long mandibles which are not crossed in repose), as well as from the remaining subgenera, by the finely faceted eyes and a build reminiscent of *Trogophloeus*, and may possibly prove to be an independent genus.

To this subgenus belongs *Bledius pruinus* Bernh. (Fauv., i, 1), which was misleadingly described by me as a *Trogophloeus* from a determination label of Fauvel. From this species the new species differs in being considerably larger, and in having strongly developed, swollen and prominent temples, broader head, longer antennae, and much shorter elytra.

Pitch-black; the front part of the body more pitch-brown; the entire antennae and legs rusty-yellow; dull, not shining, densely haired. Head a little narrower than the thorax, dull shagreened and with fine and moderately dense, anteriorly more scattered, puncturation, with elevated, fairly large, shining, antennal tubercles, with two feeble impressions between these; the eyes are comparatively small, slightly prominent, finely faceted; the temples behind them strongly developed, strongly broadened posteriorly, about as long as the longitudinal diameter of the eyes seen from above; the antennae are elongated towards the apices, only very slightly thickened, the first joint scapiform, the second elongated, the third much shorter, the others scarcely broader than long, the penultimate one moderately broader than long. Thorax a little narrower than the elytra, longer than broad, broadest in front, linearly and strongly narrowed posteriorly, with bluntly rounded posterior angles, exceptionally densely dull shagreened, not punctured along the middle zone, otherwise fairly coarsely and densely punctured, the margins at the sides very indistinct, the epipleurae very broad. Elytra scarcely longer than the thorax, longer than their combined breadth, dull shagreened and finely and densely punctured. Abdomen dull shagreened without any shine, very densely covered with grey hairs, with tufts of yellow hair laterally and across the hind margins of the tergites. Anterior and middle tibiae strongly spined. Length 4.5 mm.

Cape Province: Cape Town, Table Mt. (1906) (W. Bevins); Cape Town, Milnerton (February 1926) (R. E. Turner); Mossel Bay (October 1921) (R. E. Turner).

Thinobius (Thinophilus) iridiventris n. sp.

Related to *heterogaster* Fauv. in having the abdomen feebly iridescent and extraordinarily thickly punctate, but with somewhat similar habitus (build) to *petzi* Bernh.; from the former easily distinguished by the very long elytra.

Black, dull; elytra brown; the bases of the brownish antennae, the palps, and legs dirty yellow. Head considerably narrower than thorax, almost as long as broad, parallel-sided; vertex transversely impressed, very finely and very thickly punctate; antennae fairly long, fifth joint scarcely broader than sixth, the penultimate one as long as or somewhat broader than long, the sides gently and nearly evenly rounded, very finely and very thickly punctate, dull. Elytra nearly twice as long as thorax, much longer than their united width, extremely finely and densely shagreened punctate, matt. Abdomen extraordinarily finely punctate, the puncturation scarcely visible even with the strongest lens, but with distinct though feebly iridescent silky sheen. Length 1.2 mm.

S.W. Africa: Okahandja (2nd-18th March 1928) (R. E. Turner).

Gigarthrus harrismithi n. sp.

Related to *G. continentalis* Bernh., to which it is very similar in size, build, and coloration; but easily distinguished by its longer thorax, distinctly shagreened middle zone, and much longer, more strongly and thickly punctate elytra.

Deep black; the antennae, palps, and legs pitch-black, with sparse grey pubescence; abdomen with thick golden-yellow pubescence. Head little narrower than thorax, strongly shagreened, with strong and fairly close puncturation, feebly shiny; antennae scarcely different. Thorax almost as broad as elytra, about as broad as long, nearly parallel-sided, strongly emarginate near base, with very broad striate-shagreened middle zone, on either side with an obliquely longitudinal, non-punctate, but distinctly shagreened, broad ridge, otherwise strongly and fairly closely punctate on a distinctly shagreened ground. Elytra nearly one-third longer than thorax, slightly longer than their united width, strongly and closely punctate, but less so near the suture, and extremely finely shagreened. Abdomen somewhat widened behind, less strongly but more closely punctate than fore part of body, extremely finely shagreened, less shiny than the elytra. Length 4.5 mm.

Orange Free State: Harrismith (February 1927) (R. E. Turner).

Holotrochus opacus n. sp.

Very remarkable for its sculpture.

Black, feebly shiny, with thick grey-yellow pubescence; the antennae, palps, and legs rusty-red. Head much narrower than thorax, moderately finely and closely punctate on a finely shagreened ground; antennae moderately thickened towards apex, penultimate joints distinctly transverse. Thorax as broad as elytra, little broader than long, sides gently rounded, feebly narrowed posteriorly, with rectangular posterior angles, with a median narrow, raised, shiny line, laterally behind the middle with an obliquely longitudinal shiny ridge, otherwise strongly and thickly punctate and strongly shagreened, feebly shiny. Elytra half as long again as thorax, equally wide, much longer than their united width, shagreened but matt, finely and sparsely punctate, the shagreen almost granulate. Abdomen finely and moderately sparsely punctate, finely shagreened, rather more shiny than fore part of body. Length 3.5-4 mm.

Mashonaland: Salisbury (1910) (G. A. K. Marshall) (under bark of trees).

Stenus (Nestus) conicus n. sp.

Very similar to *S. erythraeanus* Bernh. in the coloration, especially of the abdomen, but somewhat smaller and distinguished by the following additional features:—

Head rather narrower, narrower than the elytra, transverse diameter of eye greater than half the interocular width; antennae considerably shorter and thicker, the individual joints shorter, the penultimate ones distinctly transverse in their broadest aspect. Thorax shorter, only very little longer than broad, the sides a little rounded. Elytra narrower and also shorter, more thickly rugulose-punctate. Abdomen conically pointed, base of first tergite medianly keeled, the puncturation more scattered. Upper surface less densely punctate. It may be that when more material is examined this species will prove to be a race of *erythraeanus*. Length 2.3 mm.

Mashonaland: Salisbury (1910) (G. A. K. Marshall).

Stenus (Hypostenus) silvaticus n. sp.

Deceptively like *S. alutiventris* Bernh. in build, colour, and size, but easily distinguished by the coarser and sparser puncturation on head, thorax, and elytra, and distinguished also by the distinct shagreen of the latter; distinguished also from *alutaceipennis* Bernh.

by the much coarser and much sparser puncturation of the fore part of body, much feebler shagreen on elytra and the extremely fine and sparse puncturation of the abdomen.

Head somewhat narrower than elytra, transversely circular, with two broad, shallow frontal impressions, moderately finely and moderately thickly punctate, with narrow, smooth median line; temples short but well indicated; antennae very similar to those of the above species, equally elongate, joints of the club at least twice as long as broad. Thorax much narrower than elytra, half as long again as broad, elongate, the sides gently rounded, strongly and not too closely punctate on an extremely fine and scarcely visible shagreened ground, feebly shiny. Elytra as long as thorax, shoulders strongly angularly prominent, the puncturation somewhat less strongly and distinctly more scattered on a distinctly shagreened ground, feebly shiny. Abdomen extremely finely and very sparsely punctate, less matt than fore part of body. Length 5.5 mm. (abdomen somewhat retracted).

Mashonaland: Chirinda Forest (October 1905) (G. A. K. Marshall).

Stenus (Hypostenus) parcipennis n. sp.

Belonging to the same group as the preceding species, but distinguished from it and other related species by the short, strongly and sparsely punctate, shining elytra.

Black, with very feeble bluish sheen; antennae, palps, and legs whitish-yellow. Head very large, with the strongly protuberant eyes almost broader than the thorax, with a median shallow, sparsely punctate depression, the rest strongly, laterally fairly thickly, punctate. Thorax much narrower than the elytra, not quite half as long again as broad, the sides behind the middle obtusely broadened, strongly and thickly punctate, shiny like the head. Elytra considerably shorter at the suture than the thorax, more strongly but rather sparsely punctate, very shiny. Abdomen with extremely fine, scarcely visible, and very sparse puncturation, moderately shiny. Length 5.2 mm. The ♂ has the sixth sternite gently emarginate, the fifth and fourth somewhat emarginate in the middle of hind margin, and along the median line very finely and closely punctate and pubescent.

Pondoland: Port St. Johns (10th-31st July 1923) (R. E. Turner).

Stenus (Hypostenus) tristiculus n. sp.

This species is extraordinarily close to *S. cruralis* Bernh. in general build and in sculpture and coloration, but can be easily distinguished by the pale antennal joint, the dark bases of the tibiae, much smaller head, and broader and longer elytra.

Black, matt; antennae except the pale basal joint, the apices of the reddish-yellow palps, and the legs pitch-black, basal joint of antennae not black as in *cruralis*, bases of tibiae not paler. Head but little broader than thorax, much narrower than elytra, almost smooth, with very indistinct frontal grooves, fairly strongly and extremely finely rugulose-punctate; antennae short, third joint much narrower than and nearly double as long as second, the penultimate ones somewhat broader than long. Thorax much narrower than elytra, only a little longer than broad, the sides strongly rounded and with two fine spiniform denticles, more strongly and deeply rugulose-punctate than the head. Elytra strongly developed, with strongly prominent, rectangular shoulders, coarsely and closely punctate, somewhat shiny, like the rest of the body with extremely short, silvery-white, sparse pubescence. Abdomen moderately coarsely and closely punctate, somewhat shiny. Length 3.5 mm.

In having lateral (thoracic) denticles, and in general also in coloration, build, and sculpture, this species agrees so closely with *S. quadrispinus* Bernh. that the two species might easily be confused; the new species, however, is distinguished by the distinctly stronger and less close puncturation of the whole body, but especially of the elytra and abdomen.

N.W. Rhodesia: Namwala (3rd April 1913) (H. C. Dollman).

Stenus (Hypostenus) turneri n. sp.

Very closely allied to *S. gerardi* Bernh., but distinguished by the following features:—

Head larger and considerably broader, very feebly impressed between the eyes, with very weak frontal grooves, and without any non-punctate keel between them, the puncturation closer, width between the strongly swollen eyes much narrower, much less than twice as broad as transverse diameter of eyes (in dorsal view), whereas in *gerardi* it is at least twice as broad. Thorax somewhat shorter, scarcely longer than broad, sides more rounded, without a median shiny spot, with somewhat coarse and more scattered puncturation. Elytra shorter, only very little longer than thorax, scarcely longer

than their united width, the puncturation considerably stronger and more scattered. Abdomen similarly punctate, but without the long pubescence of *gerardi*. Length 3-3.2 mm.

In the ♂ the sixth sternite is rather deeply arcuately emarginate in the middle of the hind margin, the fifth is gently emarginate, finely and closely punctate in front of the emargination, and clothed with thick, fluffy, whitish pubescence.

Zululand: Eshowe (June 1926) (R. E. Turner). Natal: Kloof (August 1926) (R. E. Turner).

Stenus (Hypostenus) natalensis n. sp.

This species is even nearer to *S. gerardi* Bernh., and in general is only distinguished by the different sculpture of the abdomen and the absence of the long pubescence. In colour the two species are scarcely different. The head is not broader than the elytra, somewhat more finely but not more closely punctate, with a similar shining median keel and with more distinct narrow shining spots above the bases of the antennae, and with a minute shiny dot on the inner margin of each eye; antennae scarcely different. Thorax but little shorter, somewhat more strongly and less closely punctate. Elytra somewhat longer, scarcely more strongly and somewhat less closely punctate. Abdomen finely and sparsely punctured, excepting the strongly punctate transverse tergal grooves. Pubescence of the body is only short and sparse. Length 4-4.2 mm. (with extended abdomen).

In ♂ the sixth joint has a shallow, triangular emargination on hind margin, the fifth scarcely emarginate, both sternites with somewhat thicker and longer pubescence along middle line than at the sides; the metasternum is impressed, strongly and moderately closely punctate, with whitish pubescence.

Natal: Frere (1910) (G. A. K. Marshall); mouth of Umkomaas River (G. A. K. Marshall); Van Reenen (January 1927) (R. E. Turner).

Stenus (Hypostenus) oligocephalus n. sp.

From the preceding species, to which it is closely related, at once distinguished by the narrow head.

Black, without distinct metallic sheen, feebly shiny; the bases of the antennae, which are brownish distally, the palps as far as the dark apices, and the basal halves of the femora reddish-yellow; the apices of the femora and the tibiae fuscous; tarsi dirty yellow. Head

slightly broader than thorax, much narrower than the elytra, moderately strongly and closely punctate, with five shiny spots, with a long raised median keel, a small keel above base of each antennae, and a minute shiny spot at the second third of inner margin of eye; antennae short, the penultimate joints almost broader than long. Thorax half as broad as the elytra, considerably longer than broad, behind the middle bluntly widened, covered all over with very close and coarse rugulose puncturation. Elytra considerably longer than thorax, with rectangular protuberant shoulders, more coarsely and somewhat less closely punctate. Abdomen posteriorly strongly and conically narrowed, everywhere closely and strongly punctate, somewhat more finely punctate posteriorly. Length 4 mm.

From the same localities.

Stenus (Hypostenus) zuluanus n. sp.

Build broader and stouter than in the preceding species, less closely and, especially on the elytra, less rugulosely punctate, more shiny.

Black; bases of antennae, entire palps, and legs bright reddish-yellow; knees broadly infusate, very thinly pubescent. Head almost as broad as elytra, moderately closely punctate, with similarly arranged but larger shiny spots as in the preceding species. Thorax much narrower than elytra, little longer than broad, behind the middle obtusely widened, strongly and not too closely evenly punctate. Elytra considerably longer than thorax, with rectangular shoulders, longer than their united width, more coarsely and sparsely, but scarcely rugulose, punctate than thorax, with strongly shiny intervals. Abdomen fairly fusiform, coarsely and moderately closely, posteriorly more finely and sparsely, punctate, strongly shiny. Length 3.5 mm.

In ♂ sixth sternite moderately deeply, arcuately emarginate, fifth gently emarginate on hind margin, finely and densely punctate along median line, with long whitish pubescence.

Zululand: Eshowe (June 1926) (R. E. Turner).

Edaphus marshalli n. sp.

This, the first *Edaphus* species to be described from South Africa, agrees very closely with the description of *africanus* Epp. from the Gold Coast. In particular the sculpture of the head, the shape of the thorax and elytra, which are strongly developed and more than twice as long as thorax, agree completely with the new species. The

structure of the antennae and the presence of only four pits on the thorax, however, negatives the specific identity of the two forms.

The new species has six deep and sharply defined pits at base of thorax. The club of the antennae is only 2-jointed, the ninth joint only a little broader than the eighth, knob-shaped, little broader than long, and only about one-third as broad as the tenth, whereas in *africanus* it is twice as broad as long, and thrice as broad as the eighth, and only half as broad as the tenth. These two characters are so important in *Edaphus* that I maintain the two species as distinct. The coloration is uniform reddish-yellow as in *africanus*. Length 1.2 mm.

Mashonaland: Salisbury (April 1908) (G. A. K. Marshall).

Pinophilus tristicollis n. sp.

Extraordinarily like *P. siculus* Kr., deceptively alike in the sculpture and distinguished only by smaller size, narrower build, considerably longer and narrower thorax, much shorter antennae, and the differently shaped eighth tergite.

Antennae fairly short, third joint shorter (in *siculus* a little longer) than second, penultimate joint in broadest aspect not oblong, as in *siculus*, but at most as broad as long. Head very similarly sculptured, moderately strongly and sparsely, irregularly punctate, and a very finely and fairly closely punctate ground. Thorax much narrower, considerably longer than broad, scarcely distinct in sculpture. Elytra also narrower, about one-third longer than their united width, not markedly different in sculpture. Abdomen somewhat more finely and sparsely punctate, more shiny, with distinct though feeble iridescence. The hind margin of seventh tergite somewhat paler, eighth tergite black, whereas in *siculus* the abdomen from the hind margin of seventh tergite to the apex is bright red-yellow. Length 10 mm. (with extended abdomen).

Mashonaland: Salisbury (1910) (G. A. K. Marshall).

Pinophilus capensis var. *rhodesianus* n.

Differing from the typical form by the short elytra, which do not equal the thorax in length, and the somewhat longer thorax. The build is also somewhat narrower. Nevertheless I consider the form as only a race of the somewhat variable *capensis*. Length 15 mm. (with extended abdomen).

N.W. Rhodesia: Namwala (28th August 1914) (H. C. Dollman).

Pinophilus semiopacinus n. sp.

This species appears to be very close to *P. congoënsis* Grid., which I do not know, but can with certainty be distinguished by the coloration and by the whole frontal region of the head being smooth and shiny.

Black; elytra blood-red; apex of the seventh and base and apex of eighth tergite yellow-red; antennae and palps reddish-yellow; legs whitish-yellow, with infuscated fore tibiae. Head almost as broad as thorax, with a transverse patch of coarse, but very shallow and superficial, punctures in front of hind margin, and near the eyes, matt, with the entire remaining surface, which medianly extends to the third quarter of the length, shiny, with a zone above the antennal tubercles and on front margin strongly, unequally, and fairly sparsely punctate, on an extremely finely and sparsely puncticulate ground; eyes strongly convex; temples behind them well developed, about one-third as long as longitudinal diameter of eyes viewed dorsally; antennae elongate, third joint much longer than second, penultimate twice as long as broad, apically clavate. Thorax as broad as elytra, somewhat longer than broad, slightly narrowed posteriorly, quite matt shagreened, and very densely covered with large, very shallow, eye-like punctures, with a shortened non-punctate median keel behind the middle. Elytra considerably longer than thorax, longer than their united width, strongly and very closely rugulose-punctate, with yellow-grey pubescence like rest of body. Abdomen strongly and moderately closely punctate, more finely so posteriorly, shining, with feeble metallic sheen. Length 12.5 mm.

N.W. Rhodesia: Kashita, N. of Broken Hill (March 1915) (H. C. Dollman).

Pinophilus (Metapinophilus) subplanus n. sp.

Just like *reticulatus* Epp. in build, but larger, broader, and distinguished by the darker coloration, finer and sparser punctures on thorax, shorter and somewhat more sparsely punctate elytra, and denser reticulate-punctate sculpture of abdomen.

Pitch-black; head and thorax somewhat lighter; antennae, palps, and legs bright reddish-yellow. Head punctate as in *reticulatus*, but the punctures are very slightly more numerous; antennae scarcely different. Thorax as in *reticulatus*, somewhat broader than long, distinctly finer and more sparsely punctate. Elytra only very little longer than thorax, scarcely more strongly but distinctly more

sparsely punctate, more shiny, shorter than their united width. Abdomen as in *reticulatus*, punctures in oblique cross-rows, but somewhat closer together. Length 8 mm.

The sexual character of the ♂ is rather different, the sixth sternite being shallowly impressed and feebly shagreened in the middle, and having the hind margin very broadly and somewhat deeply arcuately emarginate, with the margin grooved, the fifth sternite only very indistinctly emarginate, impressed medially and densely punctate, the anterior sternites without any distinctive features.

N. Rhodesia: Namwala (20th March 1913) (H. C. Dollman).

This new species is distinguished from *P. patrizii* Grid. by the larger and more robust build, the broader and shorter thorax, with its sparser puncturation, the greater shininess of thorax and elytra, and the more densely punctate abdomen.

Pinophilus deplanatus n. sp.

Most closely related to *P. infans* Epp., but distinguished at first glance by the much longer elytra and the following additional characters:—

The body is somewhat larger, darker in colour, pitch-brown; head and thorax more pitch-red; abdomen darker with redder apex; antennae whitish-yellow; palps and legs reddish-yellow. In the shape of head and its puncturation there is no essential difference. The antennae also are alike. The thorax is more finely and sparsely punctate, and more shiny. Elytra much longer, almost one-third longer than thorax, somewhat more finely and sparsely punctate. Abdomen also more finely and sparsely punctate. Length 5 mm. (with extended abdomen).

N. Rhodesia: Namwala (31st March 1913) (H. C. Dollman).

Pinophilus arrowi n. sp.

Belongs to the *brevicollis* Er. group. Distinguished from this species by the much coarser and sparser puncturation, and from the related *bolamensis* Grid., which it deceptively resembles in colour, shape, size, and sculpture, by the considerably longer elytra as well as the shorter antennae and sparser puncturation on the head. The apex of the abdomen also is not pale but black. The puncturation on the head is less extensive than in *bolamensis*, the smooth shiny interval on the front is much more extensive, its hind end reaching to level of middle of eyes, whereas in *bolamensis* this smooth patch

reaches only to the level of front margin of eyes; the punctures above the antennal bases considerably sparser; antennae distinctly shorter and less elongate, the individual joints shorter, the penultimate ones almost broader than long. Thorax somewhat shorter, about one-quarter broader than long, scarcely differing in puncturation. Elytra considerably longer, almost one-third longer than thorax and much longer than their united width. Length 8 mm.

N.W. Rhodesia: Namwala (10th September 1914); Mwingwa (27° 40' E., 13° S.) (10th-16th July and 6th August 1914) (H. C. Dollman).

Pinophilus dubius n. sp.

Also closely related to *bolamensis* Grid., but distinguished by the head sculpture, which is similar to that of *arrowi*, the much shorter thorax with considerably finer and denser puncturation, scarcely longer but much more densely and less coarsely punctate elytra, and more finely and densely punctate abdomen.

In the dense puncturation of the thorax this species approximates to *brevicollis* Er., but from the latter is easily distinguished by the much less densely punctate head and distinctly more strongly punctate thorax and elytra.

Coloration the same as that of *arrowi*, the antennae as in *bolamensis* Grid.; the body less convex than in these two species; thorax more than one-quarter broader than long, with a well-developed short, broad, shiny keel in front of the scutellum. Length 7.5 mm.

N.W. Rhodesia: Mwingwa (27° 40' E., 13° S.) (15th May 1914) (H. C. Dollman).

Pinophilus sanguinosus n. sp.

At once separated from the preceding species, with which this new species is very closely allied, by the longer thorax, much longer elytra, exceeding even those of *arrowi*, and coloration.

Black, shiny, convex, fairly narrow; elytra with the exception of the sides and broad base dull blood-red; hind margins of the abdominal segments narrowly, the apex more broadly, indistinctly reddish; antennae, palps, and legs bright reddish-yellow. Head similar to that of *arrowi*, but somewhat more densely punctate, the smooth spot smaller and more indefinite, with a few extremely fine punctures. Thorax almost as long as broad, somewhat more densely punctate, the smooth median keel on the posterior half broad and distinctly raised. Elytra a good third longer than the thorax, about one-

quarter longer than their united width, coarsely and densely rugulose-punctate. Abdomen scarcely differing. Length 8.5 mm.

Natal: Frere (1910) (G. A. K. Marshall).

Pseudoprocirrus n. g.

Distinguished at first glance from the most closely related genus *Procirrus* Lat. by the simple fourth joint of the tarsus and the broad thorax.

Build more compact, shorter, strongly convex. Head much narrower than thorax, posteriorly only moderately narrowed; neck nearly half as wide as head; eyes moderately large, rather coarsely faceted; temples as long as the longitudinal diameter of eyes, not margined below; antennae elongate, very thin, not thickened towards apex, third joint somewhat longer and much narrower than second, the following joints nearly alike, almost four times as long as broad, gradually thickened towards their apices, with the penultimate joint only twice as long as broad, clavately thickened apically, the terminal joint much shorter than the preceding; labrum truncate in front, transverse, scarcely emarginate; maxillary palps slender, second joint more than twice as long as broad, third clavately thickened towards apex, much shorter than second, terminal joint large, much longer than third, rather strongly clavate apically and obliquely truncate, so that in certain aspects it appears hatchet-shaped; the other mouth-parts not visible without dissection. Thorax strongly convex, ovate, strongly widened before the middle, lateral margins (Seitenrandlinie) strongly sinuate (gebuchtet); epipleurae particularly broad. Elytra posteriorly shallowly triangularly emarginate. Abdomen cylindrical, broad, not margined. Legs moderately slender, with the first three joints of anterior tarsi strongly broadened disk-like, longer than broad, gradually decreasing in width, the fourth very small, not expanded, not broader than the apical joint; mid and hind tarsi slender, first joint elongate, longer than the three following together, the following joints decreasing in length, fourth lobately produced below the apical joint.

Nothing is yet known about the habits of this interesting insect.

Genotype.—*P. arrowi* n. sp.

Pseudoprocirrus arrowi n. sp.

Rusty-red, moderately shiny, with thin golden-yellow pubescence, especially on abdomen; antennae, palps, and legs reddish-yellow.

Head transversely hexagonal, coarsely and densely punctate, with shiny intervals. Thorax much narrower than elytra, about one-quarter longer than broad, very strongly widened before the middle and strongly narrowed behind, punctate like the head, intervals shiny. Elytra slightly longer than thorax, parallel-sided, with strongly projecting rounded shoulders, convex, more coarsely and densely rugulose punctate than the thorax, slightly shiny. Abdomen strongly and densely, posteriorly more finely, punctate, with transverse grooves on the bases of the first four free tergites. Length 4.5 mm.

N. Rhodesia: Namwala (20th–21st March 1913) (H. C. Dollman).

Oedichirus latipennis n. sp.

In colour and shape of body very like *O. oneili* Per., but somewhat more robust, and easily distinguished by the narrow reddish-yellow hind margin of elytra, much broader blackening at the knees, and particularly by the densely punctate elytra. Head similar, punctures stronger and more numerous; antennae somewhat longer, penultimate joints almost twice as long as broad. Thorax somewhat longer, otherwise very similar, punctures in the dorsal rows and on the sides stronger and more numerous. Elytra not longer than thorax, the lateral margins rather strongly rounded with prominent shoulders, coarsely and densely and evenly punctate, smooth along hind margin and narrowly bordered with reddish-yellow. Punctures on the abdomen scarcely different. Length 7.5 mm.

N.W. Rhodesia: Mwengwa (27° 40' E., 13° S.) (19th May 1914) (H. C. Dollman).

Oedichirus arrowi n. sp.

Very closely allied to the preceding species and distinguished by the coloration, longer head and thorax, and considerably longer elytra, which are of more even breadth and less densely punctate.

Black; thorax red-yellow; only the first three completely exposed segments of the abdomen and the pectus reddish-yellow; antennae and palps yellowish, the joints chequered with blackish; legs pale yellow, the knees narrowly blackened as in preceding species. Head moderately transverse, the punctures strong and scattered. Thorax nearly half as long as broad, much more coarsely punctate. Elytra longer than their united width, sides feebly rounded, fairly parallel-sided, similar to the preceding species but rather less densely and more strongly punctate, uniform deep black, without yellow hind

margin. Abdomen similarly sculptured. Length 7.5–10 mm. (according to degree of extension of abdomen).

N.W. Rhodesia: Mwengwa (27° 40' E., 13° S.) (17th July–6th August 1914) (H. C. Dollman).

Oedichirus rhodesianus n. sp.

This species is distinguished from both the preceding species by the extensive reddish-yellow coloration of the hinder part of the elytra; from *arrowi* also by the reddish-yellow colour of the sixth (fourth free) tergite and its sternite, shorter head, longer elytra, which are much more sparsely punctate especially on the yellow-red portions; from *latipennis* by longer thorax with coarser and more numerous punctures, and by much longer and more sparsely punctate elytra. The elytra with a large red-yellow spot, extending one-third of their length at the sides, rounded inwardly and reaching the apex of suture, strongly and sparsely punctate only in front and in the middle, the broad hind and lateral margins being quite smooth and shiny. Head moderately transverse, strongly, irregularly, and not densely punctate. Thorax half as long again as broad, with numerous very coarse and deep punctures, except on the raised smooth middle band and a longer and narrower spot outside the dorsal rows and the anterior angles. Knees fairly narrowly blackened. Length 7–8 mm.

N.W. Rhodesia: Mwengwa (27° 40' E., 13° S.) (16th–18th July 1914) (H. C. Dollman).

Oedichirus dollmani n. sp.

Easily distinguished from among the red-yellow species by the longer, more parallel-sided elytra with their nearly rectangular, not bevelled off, shoulders.

Bright reddish-yellow; abdomen from seventh (fifth free) tergite deep black; antennae and palps partly blackened; legs pale yellow; knees without any infuscation. Head as broad as thorax, transverse, with a number of coarse and deep punctures, shiny, in front and behind; antennae slightly thickened apically, the penultimate joints about half as long as broad. Thorax much narrower than elytra, about one-third longer than broad, posteriorly strongly and straightly narrowed, each dorsal row with seven very coarse and pit-like punctures, and a number of similar punctures at the sides. Elytra only a little shorter than thorax, with prominent, apically rounded

shoulders, the sides distinctly rounded, widened before the apex, but nevertheless nearly parallel-sided, at the broadest part somewhat broader than length of suture, somewhat less coarsely and moderately densely, nearly evenly punctate. Abdomen with normal puncturation. Length 7.5 mm.

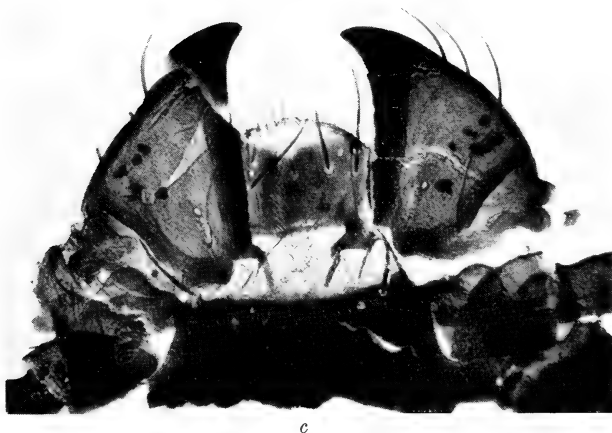
N.W. Rhodesia: Mwengwa (27° 40' E., 13° S.) (10th July 1913) (H. C. Dollman).

EXPLANATION OF PLATE XIV.

Eparchium paradoxum n. g., n. sp.

- a. Whole insect to show shape and unspined tibiae.
- b. Maxillae and labium.
- c. Mandibles and labrum.

(Photos by Prof. O. Scheerpeltz, Vienna.)



EPARCHIUM PARADOXUM, n. g., n. sp.

Dr. Max Bernhauer.

Neill & Co., Ltd.



17. *South African Stone-flies (Perlaria), with Descriptions of New Species.*—By K. H. BARNARD, D.Sc., F.L.S.

(With 21 Text-figures.)

THIS paper continues the series of reports * on the fauna of the Cape mountain ranges, which I have been investigating with the aid of grants from the Royal Society of South Africa (1917) and the Research Grant Board. My acknowledgments and thanks are herewith tendered to these bodies.

I also wish to record my grateful appreciation of the help rendered in the field work by my friend Mr. H. G. Wood, whose car has enabled us to visit several localities which otherwise would not have been possible; my thanks are also due to Mr. A. C. Harrison, who is interested in the subject from the point of view of trout, and to Mr. C. W. Thorne of the South African Museum.

The basis of our knowledge of the Nemourid stone-flies in this country is due to Dr. Tillyard (Ann. S. Afr. Mus., vol. xxx, 1931, p. 109), who worked on a small collection from the South African Museum. Nearly all these specimens were dried and pinned, and consequently often in poor condition. Moreover, in dried specimens, where the abdomen is usually shrivelled up, it is difficult to distinguish males from females. Thus in the case of some species it happened that the specimens sent to Dr. Tillyard proved to be females, while others from the same locality, which were retained in the event of the first consignment being lost in transit, proved to be males. It is not surprising that under the circumstances Dr. Tillyard assigned some of the paratype specimens to species to which they did not really belong.

Since then a large amount of fresh material has been collected, and it seems that a revision of all the specimens, including the type material returned by Dr. Tillyard, would be desirable.

A further complication is introduced by the presence of two

* Previous reports: see Trans. Roy. Soc. S. Afr., xiv, 1927; xviii, 1929; xix, 1931; xx, 1932; xxi, 1934. Stylops, i, 1932; ii, 1933. Ann. S. Afr. Mus., xxx, 1932.

distinct species occurring not only in the same general locality, but in the same portion of a stream which is being investigated, *e.g.* *A. tabularis* and *A. barnardi*. Thus it happened that males and females were collected together, and the usual assumption that they were conspecific was only disproved later by finding the correct ♂♂ and ♀♀ of both species *in copula*. This is the only safe way of correlating the sexes, and when such pairs are caught they should be preserved in special tubes separate from other captures.

Genitalia.—For the discrimination of the species the examination of the genitalia is necessary. In all cases a true diagnosis of the species can only be obtained by describing both sexes, though in some cases the males may be of greater importance owing to the often close similarity of the females.

A brief description of the component parts of the male genitalia of the local Nemourine representatives is given here, because Tillyard's paper gives a somewhat confused or even contradictory idea of them, the term "paraproct" being applied to two different structures (*loc. cit.*, pp. 120 and 124). It is not proposed to homologise the structures or to discuss the modifications of the Xth or XIth segments. The identity of the IXth segment is beyond question, the 1st segment being more or less telescoped into the metathorax, its sternite being visible between the posterior pair of coxæ. (For further information on this subject the student may consult Klapalek, 1896, SB.K. Ak. Wiss. Wien, vol. cv, Abt. 1, p. 683, and 1909, Süsswasserfauna Deutschlands, Hft. 8, p. 33; Ris. Entomol. Mitteil., vol. ii, 1913, p. 178; Despax, Bull. Soc. d'Hist. Nat. Toulouse, vol. lix, 1930, p. 139, and vol. lxiv, 1932, p. 185.)

A correct interpretation of the parts cannot be obtained from mounted microscopic preparations, which are flattened under the cover-slip. The genitalia must be examined "in the round," either after treatment with KOH or by simply clearing in a solution of parachlorophenol + chloralhydrate.

The IXth sternite is always more or less produced backwards subtriangularly to form the subgenital plate, and bears at its base a small median obovoid process. The shape of this plate is not a good specific character, as it varies both individually and according to the state of preservation; but the relative size of the basal process is a useful character.

The tergite is simple and unmodified in the genera *Aphanicerella* and *Aphaniceropsis* (as in the Nemourine genera from other parts of the world) (figs. 14, 15), but in *Aphanicerca* bears a characteristic

dorsal process projecting backwards, which varies in shape but in all the species hitherto discovered is bifid (figs. 7, 9-13). This process does not arise from the VIIth segment as Tillyard (*loc. cit.*, p. 120) says.

Desmonemoura (fig. 21), with the hind margin of the tergite produced backwards in two processes, may be regarded as an intermediate form, although these processes are an integral part of the tergite, not mobile, and thus quite different from the movable bifid process in *Aphanicerca*.

The end of the abdomen following the IXth segment gives little or no indication of being a composite segment (X + XI). The tergite of the Xth segment is more or less fully chitinised.* A single medio-dorsal chitinised area is found in *Aphaniceropsis* (fig. 14), but in the other three genera there are two such areas, which are either flat (*Aphanicerella*, *Desmonemoura*, figs. 15, 21) or swollen into variously shaped prominences (*Aphanicerca*, figs. 7, 9-13). In the latter genus Tillyard (*loc. cit.*, p. 120) has termed these areas "paraprocts," though, strictly speaking, they lie dorsal to the anus, which is situated between the cerci. In this paper the term paraproct will not be used, and the areas in question will be referred to as the dorsal plate or plates of the Xth segment.

Posterior to the dorsal plate or plates of the Xth segment is a single median process (not a double process as stated by Tillyard, *loc. cit.*, pp. 120, 122), upturned or curved forwards and variously shaped. This is the supra-anal lobe of Klapalek and Ris. In *Aphaniceropsis* and *Aphanicerella* this process does in some positions appear to be composed of two halves owing to the strong chitinisation of the lateral margins. At its base these chitinised margins are continued into two struts, which bend round sharply and articulate with the Xth tergite. In *Aphaniceropsis* they meet the two posterior prolongations of the median dorsal plate (fig. 14). In *Aphanicerella* they connect with a crescentic transverse strut lying behind a more or less triangular-shaped plate interpolated between the two dorsal plates of the Xth segment (figs. 15-17, 19, 20). In *Desmonemoura* they lie between the strongly chitinised inner margins of the dorsal plates, and gradually peter out into the intervening membrane (fig. 21).

The lateral portions of the Xth segment may be termed pleurites. In *Aphanicerca* these areas are feebly demarcated from the tergal portion; in *Aphaniceropsis* they are better defined, and in *Aphani-*

* The term "chitinised" is used for those areas which are firmer in texture and more or less deeply pigmented, as contrasted with the thin membranous areas like the intersegmental articular membrane.

cercella they form definite plates with acutely produced and strongly chitinised apices; they are capable of considerable lateral movement, and in fact function as claspers (vide *infra*). In *Desmonemoura* they are also well defined, but not capable of much movement in their basal portion; the falcate process is clearly an extreme development of the pointed apex found in *Aphanicercella*, and taken as a whole the pleurite would seem to function as a clasper.

The cerci are attached to, or slightly internal to, the postero-inferior margins of the pleurites (cf. Klapalek, 1896; Despax, 1930).

The ventral or sternal portion of the Xth segment is regarded as absent (Klapalek, 1909; Despax, 1930), though Ris (1913) believed the curved struts supporting the subanal lobes and penis (or titillators) to be the remnants of it. Despax (1932) follows this interpretation. The subanal lobes and penis may be the modified remnants of the XIth sternite (Klapalek, 1909; Despax, 1930).

In the South African forms the curved chitinised struts are distinct, short in *Aphanicercella*, but longer in the other genera. They are continued distally, without, however, any articulation or joint, into a median bilobed process of varying shape. This may be termed penis or titillators; the latter term is used here, as this structure does not appear to be the external continuation of the vasa deferentia, though it is in fact an intromittent organ or channel for the passage of the sperm. It is an important diagnostic character of the species.

♀ *Genitalia*.—The vulva is situate on the VIIIth segment, but the position of the subgenital plate varies. In *Aphanicercella* it is on the VIIth segment, but in all the other genera it is on the VIIIth.

The chitinisation of the abdominal segments is variable. Segments II–VI are always membranous, except certain areas on the sternites, which are more or less strongly chitinised. Details of these are given under the different species. In *Aphanicercella* segments VII–X, and in *Aphanicercopsis* segments VIII–X, are completely chitinised. In *Aphanicercella* segments VII, IX, and X are chitinised, while VIII is membranous and pale, except in one species (*nigra*) where there are small chitinised pleural areas. In *Desmonemoura* the tergites of VII and VIII are membranous, the VIIth sternite and genital plate being slightly chitinised; IX and X are chitinised dorsally but membranous ventrally.

Act of Copulation.—In those genera without well-developed pleurites the sexes as a rule separate on being captured. In *Aphanicercella*, however, where the pleurites form claspers, it is comparatively easy to secure and preserve pairs which remain in copula.

In all cases, except *Desmonemoura* in which the act has not been observed, the ♂ and ♀ lie side by side, both abdomens turned slightly

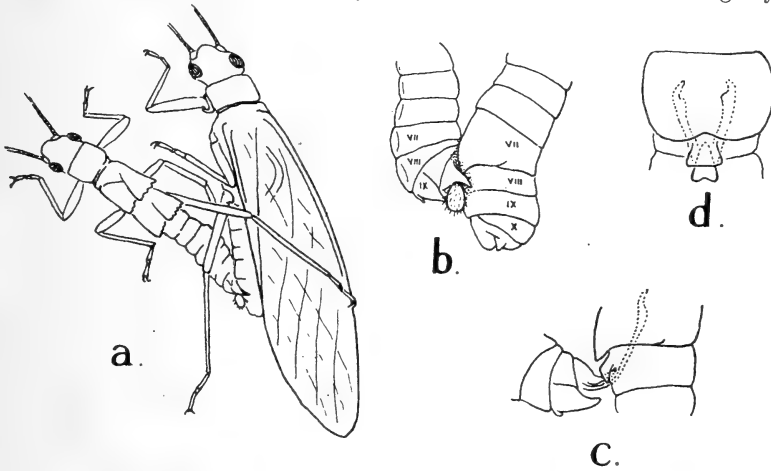


FIG. 1.—*Aphanicerella barnardi* Tillyard. a, ♂ and ♀ showing position in copula, wings of ♂ removed; b, dorso-lateral view of ♂ and ♀ abdomens; c, d, lateral and ventral views showing supra-anal lobe and titillators of ♂ within vulva of ♀ (diagrammatic; pleurite and cercus in c omitted).

towards one another, and the apex of the ♂ abdomen curved upwards and slightly forwards (figs. 1 and 2). In *Aphaniceropsis* and *Aphanicerella* the supra-anal lobe enters the vulva, the denticles on its lower margin engaging the ventral wall of the vulva and serving to anchor the lobe in position. The object of the lobe seems to be to prepare the way for the entry of the more delicate titillators or intromittent organs, which penetrate the oviducts to their full extent.

In *Aphanicerca* the mating position is the same, and it cannot be doubted that the supra-anal lobe enters the vulva; but the sexes separate so readily that it has not been possible to secure a pair in copula, in spite of many attempts with the common *A. capensis*. The bilobed dorsal process of the IXth segment probably acts as a clasper.

Oviposition has not been observed, but the ripe eggs of some of the species are described below.

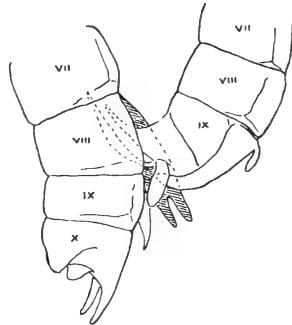


FIG. 2.—*Aphaniceropsis tabularis* n. sp. Semi-diagrammatic view of ♂ and ♀ abdomens in copula.

Nymphs of all four Nemourine genera are practically indistinguishable. The correlations with the imago have been made by collecting examples in the last instar just prior to emergence of the adult. In such examples the wing-cases are black, and the genitalia are visible through the nymph skin and can be easily dissected out.

The adults may be bred out if the nymphs are so far advanced that it is necessary to keep them only a day or two in captivity. Nymphs in earlier stages do not seem to take kindly to confinement

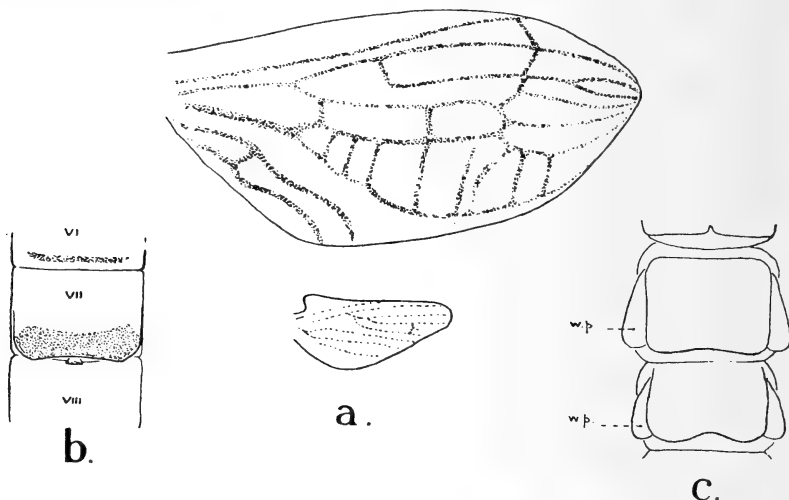


FIG. 3.—Micropterous and apterous forms. *a*, fore- and hind-wing, to same scale, of *Aphanicercella* ♀ from Robinson Pass; *b*, ventral view of abdominal segments VI–VIII of same; *c*, dorsal view of meso- and meta-thorax of ♀ *Aphanicercopsis* from Palmiet River, showing wing-pads (w.p.).

in still water, even if frequently changed; but serious attempts to breed them have not been made, as it was found so simple to collect examples ready to hatch.

Micropterism and Apterism.—Reduction of the wings in one or both sexes has been recorded in several genera and species (*cf.* Klapalek, 1909, *loc. cit.*; Sharp, *Cambr. Nat. Hist.*, vol. v, 1895, pp. 405, 406; and Despax, *loc. cit.*, 1932, p. 539). Sharp remarks that the phenomena are “worthy of more detailed investigation.”

Up to the present only one case of micropterism and two cases of apterism have been observed among South African stone-flies.

A micropterous ♀ of the genus *Aphanicercella* was found at Ruiterbosch, Robinson Pass, Outeniqua Range (K. H. B. and H. G. W., February 1932). The abdomen has very similar characteristics to

those of the River Zonder End or Tradouw Pass form of *bifurcata*; the total length is 6 mm., which is about normal for this species (cf. figs. 3, b, and 18, b). (The Outeniqua Range is a continuation of the Langeberg Range in which Tradouw Pass is situated.) The fore-wing measures 2 mm. in length, but shows the typical venation (cf. Tillyard, *loc. cit.*, fig. 3), the distal portion of the wing having suffered most from the shortening. All the veins are thicker than in a normal specimen (cf. Despax, *loc. cit.*, figs. 1-3). This is not a specimen which has failed to expand its wings on emergence, because the wings normally are very nearly their full size and lie crumpled up within the nymphal wing-pads. The hind-wing is only about a third of the length of the fore-wing, and is markedly degenerate, with very faint and inconspicuous veins.

At Palmiet River (near the village of Kleinmond) Mr. H. G. Wood found two apterous ♀♀ of a species of *Aphaniceropsis*, probably *A. denticulata*, along with normal ♂♂ and ♀♀ of this species. They are 5 mm. in length, as against 7 mm. in the normal winged specimens. Both pairs of wings are represented by short pads (fig. 3, c).

An apterous ♂ of *Aphaniceropsis hawaquae* was found at Jonkershoek (K. H. B. and H. G. W., 10th June 1932). It has the characteristic genitalia of this species, and measures 4 mm. in length (normal 5 mm.). It has no trace of wings, not even pads as in the Palmiet River ♀♀.

Economics.—Stone-flies and their nymphs are valuable food for trout in the Western Province. Although abundant at certain seasons, the flies are small and inconspicuous, and consequently not much observed by anglers, except perhaps the Porcupine Stone-fly. This and the Common Cape Stone-fly are the only ones to which colloquial names may usefully be given.

Distribution.—The moderately large stone-flies of the family Perlidae are tropical and subtropical forms. The specimen from Upington on the Orange River and those from Natal constitute the most southerly records in South Africa.

The Nemourine stone-flies, on the other hand, are a temperate group. So far as yet known, they occur in the Cape mountain ranges, as far north as the Cedar Mountains (Clanwilliam District) and as far east as George. It would be very interesting to discover how much farther east they extend.

The Common Cape Stone-fly (*Aphanicerca capensis*) and its varieties has a fairly wide distribution in the Western Cape Province, and occurs more or less throughout the year. The other species of

this genus and those of *Aphanicercopsis* and *Aphanicercella* appear to be more local, though this may be due to lack of collecting just at the right season. The species of these latter two genera seem to be winter, spring, and early summer flies, at least in the western portions of the Cape region.

FAMILY PERLIDAE.

1909. Klapalek, Süßwasserfauna Deutschlands, Hft. 8, p. 42 and p. 84 (nymph).

1923. *Id.*, Coll. Zool. Selys Longchamps, fasc. iv, 2, p. 9.

1921. Rousseau, Larves et Nymphes Aquatiques, vol. i, p. 291 (nymph).

Subfamily NEOPERLINAE.

1931. Tillyard, Ann. S. Afr. Mus., vol. xxx, p. 114.

Two ocelli. Two axillary veins (*i.e.* a forked 2A) from basal anal cell in fore-wing.

Gen. *Ochthopetina* End.

1909. Enderlein, Stettin. Entomol. Zeit., 70 Jahrg., p. 324.

1909. *Id.*, Zool. Anz., vol. xxxiv, p. 398 (key to species).

1923. Klapalek, *loc. cit.*, p. 175.

1931. Tillyard, *loc. cit.*, p. 114.

The ocelli much nearer to one another than to inner margins of eyes. No cross-veins beyond the anastomosis (transverse cord) except in pterostigmal area. Cerci long. First two tarsal joints very short, 3rd long. Fused Rs + MA in hind-wing usually longer than its branches (as far as anastomosis), or at least as long as the shorter (MA) branch. Wings folded back flat over abdomen. IXth sternite in ♂ somewhat parabolically produced. Xth (or XIth) tergite with 2 medianly directed blunt processes, each bearing a forwardly directed slender process. Subgenital plate ♀ (VIIIth sternite) not, or only a little, broader than the other sternites, sometimes extended by an accessory plate on mid-hind margin.

Nymph with 4 or 6 pairs of thoracic gill-tufts and one pair of anal gill-tufts. Inner lobes of labium small. Labial and maxillary palps slender. First 2 tarsal joints very short.

Remarks.—Tillyard accepts Enderlein's genus, saying he is unable to criticise the grouping of the Ethiopian and Oriental species in a

genus distinct from *Neoperla*. Klapalek also accepts the genus. Navas (Rev. Zool. Afric., vol. xxi, 1931, p. 2, and vol. xxii, 1932, p. 3) has described further new species from the Congo under the name *Neoperla*, based on ♀♀ only, and consequently of doubtful validity.

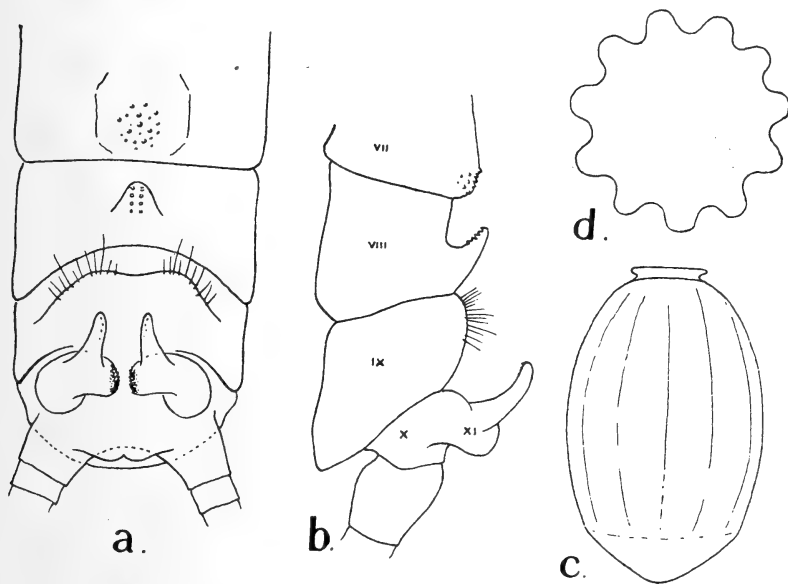


FIG. 4.—*Ochthopetina transvaalensis* (End.). a, b, dorsal and lateral views of end of abdomen ♂; c, d, lateral view and cross-section of egg.

Ochthopetina transvaalensis (End.).

1909. Enderlein, Zool. Anz., vol. xxxiv, p. 402 (♀).

1923. Klapalek, *loc. cit.*, p. 140, fig. 13 (♀).

1931. Tillyard, *loc. cit.*, p. 115, fig. 1 (part).

Tillyard has mentioned the variability of the venation and other features.

Enderlein's description of the VIIIth sternite of ♀ is correct, viz. not differing from the other sternites, with straight hind margin and without sculpture. The appearance described by Klapalek is erroneous and due to shrinkage (I have examined the two specimens returned to the South African Museum with Klapalek's labels—Klapalek evidently did not relax either of them).

♂ *Genitalia* (fig. 4).—VIIIth tergite with a slightly more strongly chitinised squarish patch bearing a median group of conical granules

or denticles; VIIIth tergite with a median conical forwardly directed process bearing 2 rows of denticles on its lower (anterior) surface; IXth tergite with 2 broadly rounded humps bearing long setae but no granules; copulatory processes with a few denticles apically on their lower surfaces.

Eggs (fig. 4) not quite .5 mm. in length, barrel-shaped, with 11-13 rounded longitudinal ribs and a reflexed rim at the micropylar end.

Nymph (fig. 5).—Klapalek (1912, *Ergebn. Deutsch. Zentralafri. Exp. III Zool.*, vol. i, pp. 447 sqq.) has described one form of *Neoperla* nymph from Rukarara stream, Ruanda, and two others from west of Lake Albert Edward. All these forms possess 7 pairs of gills.

Lestage (1917, *Rev. Zool. Afric.*, vol. v, 2, pp. 135 sqq.) has described three specimens, all collected on the same day and at the same locality (Maba River, near Mlonda), which he apparently considers as representing three species. Each one possesses 5 pairs of gills.

The specimens here described resemble Klapalek's specimens in having 7 pairs of gills, and are without doubt to be assigned to *transvaalensis*. Some full-grown specimens were collected by Mr. S. A. Hey on the Inland Fisheries Survey, either in Natal or the Transvaal. One empty shuck came from Krantzkop (K. H. B., 1917), the same locality where the above described ♂ was caught; and three half-grown specimens were collected by Mr. J. C. Dendy in the Olifants River, near Satara, Transvaal.

Size.—Up to 17 mm.; cerci 10 mm.; width of pronotum 3.5 mm. This is about the maximum size (for ♀♀), as the empty shuck also measures 17 mm.

Colour (as preserved).—Castaneous or sepia brown; legs, cerci, and antennae ochraceous; light ochraceous patches as follows: a band between the eyes, a transverse bilobed patch on prothorax, a sub-triangular or cordate patch on both meso- and meta-thorax and on hinder half of Xth abdominal segment, transverse bands on hind margins of abdominal segments II-IX; gill-tufts whitish.

The structural details will be seen from the figure. The position of the gill-tufts correspond with Klapalek's description. The tuft above the insertion of fore-leg is really a double gill, as is also that above the middle leg, but is counted as only one.

In some of the full-grown nymphs eggs are already developed, and agree with those extracted from the imago (*supra*).

Remarks.—The original Zoutpansberg specimen was a ♀, and the Lydenburg specimen (editor's footnote in Tillyard, p. 115) is also

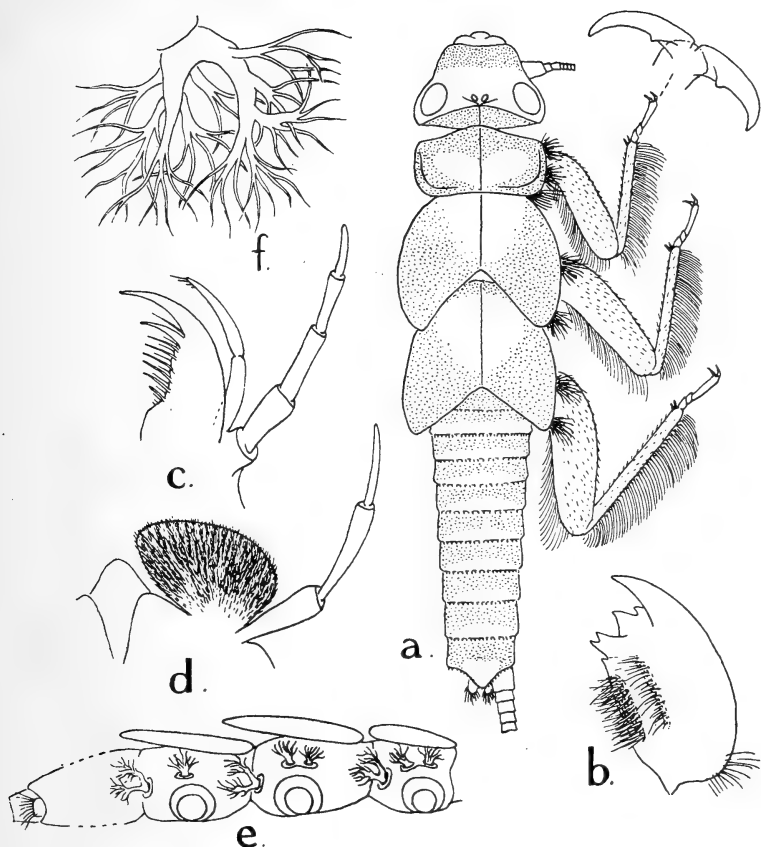


FIG. 5.—*Ochthopetina transvaalensis* (End.). *a*, nymph, with claw further enlarged; *b*, ventral view of mandible; *c*, *d*, maxilla and labium, the median lobe in the latter figure is the hypopharynx; *e*, semi-diagrammatic lateral view of thorax and end of abdomen (other abdominal segments and the right cercus omitted) to show gill-tufts; *f*, a double gill from between pro- and meso-thorax.

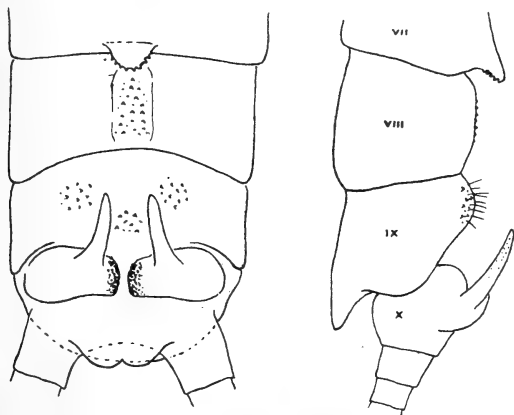


FIG. 6.—*Ochthopetina kunenensis* n. sp. Dorsal and lateral views of end of abdomen ♂.

a ♀. As no ♂ is known from the Transvaal, it is therefore an assumption to identify the Natal and Zululand specimens with this species, though the identity will probably prove to be correct.

The only ♂ I have seen is the Krantzkop specimen. The genitalia are very similar to those of *leroiana* Klap. (see 1923, p. 138, figs. 11, 12) from Redjaf in the Lado Enclave. In fact, but for the difference in shape of the pronotum, there might be some reason for considering *leroiana* a synonym.

Ochthopetina kunenensis n. sp.

1931. Tillyard, *loc. cit.*, p. 115 (*transvaalensis* part, non End.).

Resembling *transvaalensis* in all characters, including the VIIIth sternite of ♀, but distinguished by the ♂ genitalia.

♂ (fig. 6).—VIIth tergite with conical, backwardly projecting median process on hind margin, bearing denticles; VIIIth tergite with a slightly more strongly chitinated median band bearing conical granules or denticles; IXth tergite with 2 rounded humps bearing conical denticles and long setae, and between the humps a third patch of denticles; copulatory processes slender, without any denticles.

Colour and size as in *transvaalensis*, ♂♂ smaller than ♀♀.

Locality.—Erikson's Drift and Otjimbumbé, Kunene River, South West Africa (K. H. B. and R. F. Lawrence, March 1923).

Remarks.—The ♂ genitalia closely resemble those of *africana* Klap. (see 1923, p. 133, figs. 4, 5) from the Cameroons, but differ in the shape of the chitinated patch on the VIIIth tergite, and the presence of a third group of denticles on the IXth tergite.

The Upington specimen (editor's footnote in Tillyard, *loc. cit.*, p. 115) is a ♀, and consequently unidentifiable. It would be extremely interesting to obtain a ♂ from this, or some other locality, on the Orange River.

FAMILY NEMOURIDAE.

1909. Klapalek, *loc. cit.*, p. 69 and p. 92 (nymph).

1921. Rousseau, *loc. cit.*, pp. 119 (nymph), 314.

1926. Tillyard, *Insects Austr. and New Zeal.*, p. 119.

Three ocelli.

Subfamily NEMOURINAE.

1931. Tillyard, *loc. cit.*, p. 116.

Second tarsal joint much shorter than either of the others.

Nymph without gill-tufts (in the South African species).

Remarks.—The nymphs of the species of the four genera described below are extraordinarily alike. Only nymphs in the last instar showing the genitalia of the imago within the nymphal skin, and the empty shucks of specimens bred in captivity, have been used in these descriptions. The correlations therefore are beyond doubt.

Tillyard (*loc. cit.*, pp. 128, 129, figs. 12, 13) briefly mentioned two nymphs, one of which was ascribed to *Aphanicerca* on the wing venation. As, however, the wing venation offers no reliable differential characters between the local genera, the identity of that nymph remains indeterminable.

Gen. *Aphanicerca* Tillyard.

1931. Tillyard, *loc. cit.*, p. 117.

Imago.—No cross-veins beyond the anastomosis, except the distal intercubitals. Sc ending on costa at about the middle. Rs arising almost or quite perpendicularly from R. MA arising at an angle separately from Rs. All veins distal from the anastomosis (transverse cord) evenly spaced, subparallel. Between MA and Cu_1 only 2 (rarely 3) cross-veins proximal to anastomosis. In hind-wing Rs and MA arising by short common stalk from R; a single intercubital cross-vein distal from the anastomosis; anal fan narrow, with 5 simple veins. Wings folded back and slightly wrapped round the abdomen; more or less suffused; fore-wing with clear patch in middle.

IXth tergite ♂ with backwardly directed bifid process; IXth sternite elongate, more or less triangular, with short median basal process. Xth tergite divided into two variously shaped, gibbous plates, behind which is the recurved supra-anal lobe. Titillators more or less elongate; internal supporting struts slender, long. Pleurites not well demarcated. Cerci short, cylindrical, one-jointed.

In ♀ abdominal segments VII–X completely chitinised; segments II–VI with chitinised plates on sternites only. These plates are more or less trapezoidal, but may be reduced to a band across the posterior half of each segment, though those on segments II and VI are seldom reduced. Subgenital plate on VIIIth segment, more or less produced. Subanal plates more or less triangular. Cerci very short, conical.

Egg and nymph, see under *capensis*.

Genotype.—*A. capensis* Tillyard.

Remarks.—The nymph of *capensis* is known, but not those of the other species. In view of the similarity of the nymphs in the four Nemourine genera there are hardly likely to be any *specific* differences.

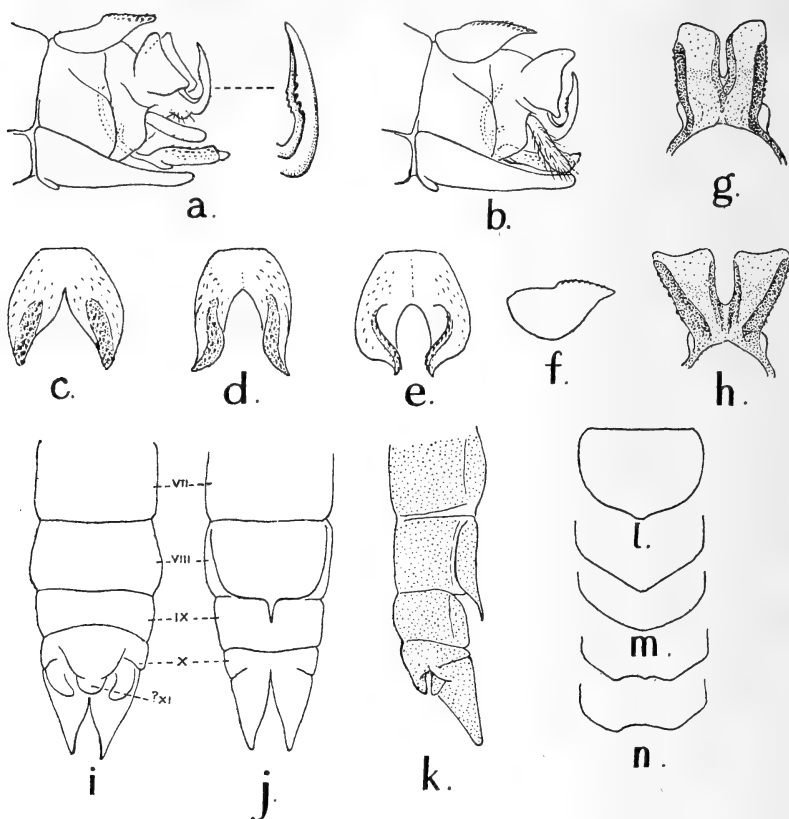


FIG. 7.—*Aphanicerca capensis* Tillyard. *a*, lateral view of genitalia of ♂ from Table Mt. (typical form), with supra-anal lobe further enlarged; *b*, the same of specimen from Wellington Mts., in normal resting or retracted position; *c*, *d*, dorsal view of dorsal processes of Table Mt. and Wellington forms respectively; *e*, *f*, dorsal and lateral views of same of Montagu Pass form; *g*, *h*, dorsal view of titillators of Table Mt. and Tulbagh Valley forms respectively; *i*, *j*, *k*, dorsal, ventral, and lateral views of abdomen of ♀ from Table Mt.; *l*, *m*, *n*, subgenital plate of ♀ of vars. *a*, *β*, *γ* respectively, two varieties each of vars. *β* and *γ*.

Aphanicerca capensis Tillyard.

(Common Cape Stone-fly.)

1931. Tillyard, *loc. cit.*, p. 119, figs. 2–4 (part: holotype from Table Mt., and paratypes from Wellington, Klein Drakenstein, and Tulbagh).

Imago.—In addition to the characters given by Tillyard, the

frontal warts on head are small, subcircular, about one ocellus-diameter in front of, and slightly external to, the hinder ocelli. Fork of R_{2+3} and R_{4+5} in fore-wing sometimes sessile or almost so, sometimes the stalk as long as or even a trifle longer than the cross-vein $R_{2-5}-MA_1$.

♂ *Genitalia*.—Dorsal process of IXth tergite divided into two lanceolate halves, each with a band of posteriorly directed spinules or denticles distally, the length of the band about half length of the process. Dorsal plates of Xth segment upstanding, in side view quadrangular, bluntly pointed at both ends. Supra-anal lobe scimitar-like, with 4-5 denticles in middle of each margin of the groove on its concave (anterior) face. Titillators robust, the lateral strongly chitinised margins bearing spinules, the membranous apex rounded or truncate, the inner chitinised supports not produced.

♀ *Genitalia*.—Subgenital plate broadly ovoid, with narrow acute median point on hind margin. Very occasionally specimens with a blunt point (see var. *a*, *infra*) are found. Subanal plates triangular, apically acute.

Fore-wing.—♂ 7-8 mm., ♀ 8-9 mm. (sometimes 10 mm.).

Colour as given by Tillyard.

Eggs round-oval, .18-.2 mm. long diameter, surface feebly reticulate, no micropylar projection.

Nymph.—General characters as in fig. 8. Prothorax transversely subquadrangular. Labrum transverse, distal margin very slightly concave. Mandibles often with the main cutting teeth more worn down and blunter. Maxillary palp not extending much beyond the galea and lacinia, which are subequal. Labium with outer lobes somewhat stouter than the inner lobes. Both the maxillary and labial palps show a minute rudiment of another joint on the terminal joint; this is best seen in empty shucks. Spinules on the wing-cases short, acute. Legs and abdomen shortly hirsute and with short spinules.

Length up to 7-8 mm.

Colour.—Uniformly ochraceous, the knees and wing-cases becoming dark before emergence of the imago.

Locality.—Typical (holotype) form, streams on the slopes of Table Mt., Cape Town.

Specimens from localities outside the Cape Peninsula show slight variations in the ♂ and ♀ genitalia, but not enough to justify varietal names.

Var. *a* (1931, Tillyard, *loc. cit.*, p. 121, paratype ♂ and ♀ from Wellington and Klein Drakenstein).—Usually somewhat smaller than

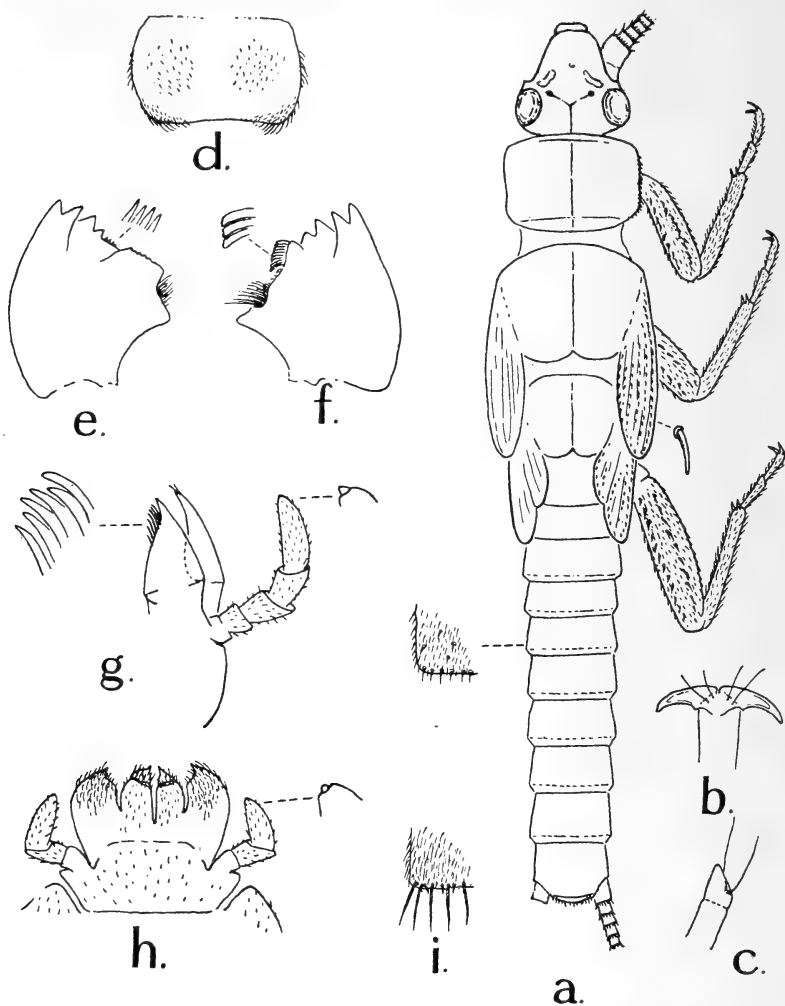


FIG. 8.—*Aphanicerca capensis* Tillyard. *a*, nymph, with portion of abdominal integument further enlarged; *b*, *c*, claw and junctions of the three tarsal joints further enlarged; *d*, labrum; *e*, *f*, right and left mandibles from below; *g*, *h*, maxilla and labium.

Aphanicercella barnardi Tillyard. *i*, portion of abdominal integument for comparison with that of *Aphanicerca*.

the Table Mt. form; fore-wing ♂ 6.5–7, ♀ 8–9 mm. (paratype ♂ has wings 6.5, not 5.8 mm. as given by Tillyard). Dorsal processes of IXth tergite ♂ shorter, deeper in lateral view, with relatively longer

band of spinules. Subgenital plate ♀ with short, blunt median point, which is sometimes almost obsolete.

Localities.—Wellington Mts., Seven Sisters (K. H. B., October 1931) and Witte River (H. G. W., October 1933).

Fairy Glen, Brandwacht, Worcester (K. H. B. and H. G. W., August 1932).

Gt. Winterhoek Mts., Tulbagh (K. H. B., September 1932; K. H. B. and H. G. W., November 1932).

French Hoek Pass (east side) (K. H. B. and H. G. W., December 1932 and October 1933).

Bosch Kloof, Keeromberg, Worcester (H. G. W., January 1933).

Cedar Mts., Clanwilliam (K. H. B., October 1934).

Var. β (1931, Tillyard, *loc. cit.*, p. 121, paratype ♂ and ♀ mounted on slides, Gt. Winterhoek Mts.).—Subgenital plate ♀ with evenly rounded hind margin, sometimes somewhat angular but without any definite point. The titillators in ♂♂ from the Tulbagh Valley are broader than in the typical form.

Locality.—Gt. Winterhoek Mts., in the Sneeuwgat (Twenty-four Rivers drainage system) and streams on the Tulbagh side (Little Berg River system) (K. H. B., September 1932; K. H. B. and H. G. W., November 1932 and October 1933).

Var. γ.—Subgenital plate ♀ apically truncate and slightly excavate, with or without a slight median point.

Localities.—Palmiet River, Southern Hottentots Holland Mts., near Kleinmond (H. G. W., July 1932 and December 1933).

Hottentots Holland Mts. (Landdrost) (K. H. B., January 1916 and January 1933).

Oudebosch, River Zonder End Mts. (H. G. W., January and September 1933; K. H. B. and H. G. W., January 1934).

At the following localities only ♂♂ have been captured. In ♂♂ from Montagu Pass the dorsal processes of IXth tergite are very deep in lateral view, and in dorsal view are more strongly incurved (fig. 7, *e, f*).

Robinson Pass, Outeniqua Mts., north of Mossel Bay (K. H. B. and H. G. W., February 1932).

Montagu Pass, Outeniqua Mts., north of George (H. G. W., April 1933).

Remarks.—In the Cape Peninsula a succession of broods occurs throughout the year, except for a short period in mid-winter and late summer, corresponding with the wettest and driest months. The actual dates between which no imago have been found are

1st May to 11th July and 7th January to 29th March. After the summer break the young nymphs begin to appear towards the end of February and early in March.

The flies are found on rocks projecting from and bordering the streams or on neighbouring tree-trunks and bushes. They run rapidly when disturbed and take short flights. On calm warm evenings they can be seen rising above the vegetation and taking more sustained flights.

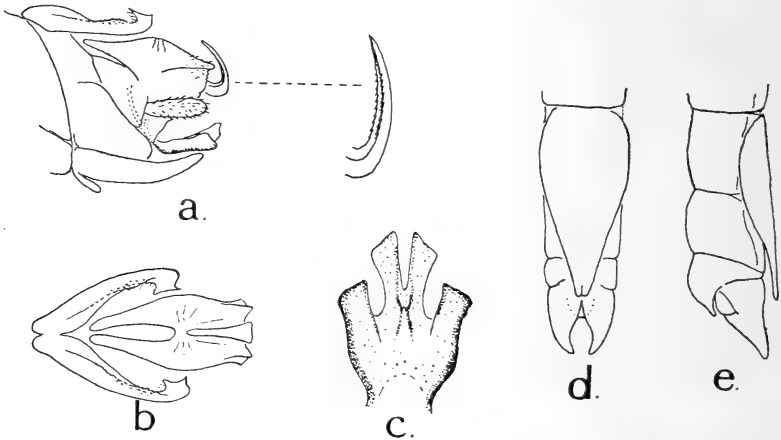


FIG. 9.—*Aphanicerca uncinata* n. sp. *a*, lateral view ♂ genitalia with supra-anal lobe further enlarged; *b*, dorsal view of dorsal processes of IXth and dorsal plates of Xth segments; *c*, titillators; *d*, *e*, ventral and lateral views ♀ genitalia.

Aphanicerca uncinata n. sp.

Imago.—Venation and other characters as in *capensis*.

♂ *Genitalia*.—Dorsal process of IXth tergite divided almost from base into two slender, divergent, apically recurved and truncate processes, their dorsal margins raised and spinulose before the bend and setulose in the bend. Dorsal plates of Xth tergite fusiform, with strong anterior projection; supra-anal lobe scimitar-like, tapering evenly, with several small serrulations on each margin of the groove on its concave face. Titillators bilobate, margin of outer lobes strongly chitinised, not spinulose, the margin of inner lobe not so strongly chitinised, both lobes apically truncate.

♀ *Genitalia*.—Subgenital plate of VIIIth segment elongate, extending beyond end of IXth sternite, lanceolate, tapering to a subacute or narrowly rounded apex, which is shortly cleft. Subanal plates triangular, apically acute.

Fore-wing.—♂ 4·5–6 mm., ♀ 7–8 mm.

Colour as in *capensis*.

Locality.—Hottentots Holland Mts. (east side of the Sneeuwkop, Landdrost Kop, and Sugar Loaf) (K. H. B., January 1916, 3 ♂♂, 1 ♀, and March 1919, 1 ♀; K. H. B. and H. G. W., January 1933, ♂♂♀♀).

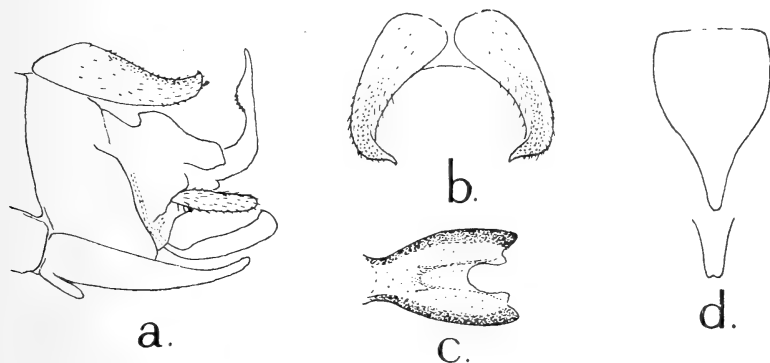


FIG. 10.—*Aphanicerca lyrata* n. sp. a, lateral view ♂ genitalia; b, dorsal view of dorsal processes of IXth segment; c, titillators; d, subgenital plate ♀.

Aphanicerca lyrata n. sp.

1931. Tillyard, *loc. cit.*, p. 121 (paratype ♀ from Jonkershoek).

Imago.—Venation and other characters as in *capensis*.

♂ *Genitalia*.—Dorsal process of IXth tergite divided into two stout, divergent, apically incurved processes, strongly chitinised distally, dorsal margins in distal half minutely denticulate. Dorsal plates of Xth tergite with anterior corner not very prominent, shortly acute; supra-anal lobe as in *capensis* but with more prominent convexity bearing the serrations. Titillators lobiform, apically blunt, in section like two angle-iron pieces [— —] connected ventrally by feebly chitinised membrane; apices somewhat sharply incurved; outer margin not spinulose.

♀ *Genitalia*.—Subgenital plate not quite so elongate as in *uncinata*, rapidly narrowing in distal half to a sharp apex, which may be minutely notched. Subanal plates acute.

Fore-wing.—♂ 7–7·5 mm., ♀ 8–9 mm.

Colour as in *capensis*.

Locality.—Jonkershoek, Stellenbosch (K. H. B., May 1924, 1 ♀; H. G. W., May 1932, 3 ♂♂, 5 ♀♀; K. H. B. and H. G. W., June 1932, ♂♂♀♀).

Aphanicerca bicornis n. sp.

Imago.—Venation and other characters as in *capensis*.

♂ *Genitalia*.—Dorsal process of IXth tergite divided from near base into two slender (sometimes a little stouter than represented in the figure, but never as stout as in *lyrata*), widely separated, sub-parallel or curved processes bearing granules and stout conical spinules dorsally in distal half; apices acute. Dorsal plates of Xth

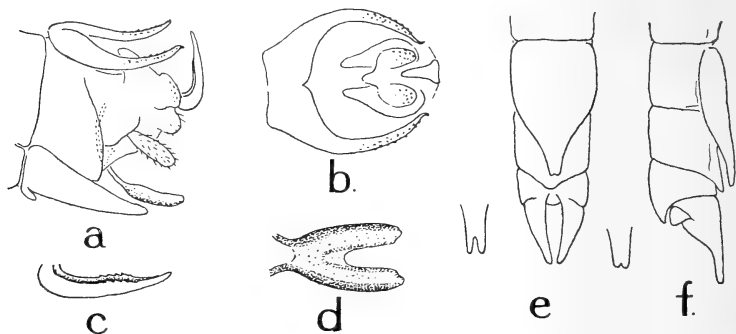


FIG. 11.—*Aphanicerca bicornis* n. sp. a, lateral view ♂ genitalia; b, dorsal view of dorsal processes of IXth, and dorsal plates of Xth segments; c, supra-anal lobe; d, titillators; e, f, ventral and lateral views ♀ genitalia, with variations of apex of subgenital plate.

tergite similar to those of *lyrata*, but anterior angle more rounded, posterior half strongly chitinised, with minute denticles; supra-anal lobe thin, with a feeble bulge where the denticles are situated. Titillators lobiform, similar to those of *lyrata*.

♀ *Genitalia*.—Subgenital plate lanceolate, produced to a feebly bifid or shortly cleft setose point, extending almost to end of IXth sternite. Subanal plates triangular, abruptly narrowed in middle; apices acute.

Fore-wing.—♂ 6·7·5 mm., ♀ 8·8·5 mm.

Colour as in *capensis*.

Localities.—Du Toit's Kloof, Rawsonville (K. H. B., 1st June 1930, 1 ♂).

Bain's Kloof, Wellington Mts. (east side) (K. H. B. and H. G. W., 1st May 1933, 1 ♂, 2 ♀♀).

Fouche's Hoek, Mostertshoek Mts. (K. H. B., 17th April 1933, ♂♂).

Zanddrift Kloof, Hex River Mts., Worcester (K. H. B., 20th April 1930, 1 ♀).

Jan du Toit's Kloof, Waaihoek (R. Anson Cook, 13th May 1934, 1 ♀).

French Hoek Pass (east side, River Zonder End headwaters) (H. G. W., 7th May 1933, 3 ♂♂, 1 ♀).

The first five localities are in the Breede River system; the River Zonder End eventually also joins the Breede River.

Aphanicerca bovina n. sp.

Imago.—Venation and other characters as in *capensis*.

♂ *Genitalia*.—Dorsal process of IXth tergite divided from near base into two lanceolate processes, the acute apices slightly curved,



FIG. 12.—*Aphanicerca bovina* n. sp. a, lateral view ♂ genitalia; b, dorsal view of dorsal processes of IXth, and dorsal plates of Xth segments; c, titillators; d, inner (anterior) view of supra-anal lobe.

dorsal surface distally setose and spinulose. Dorsal plates of Xth tergite anteriorly broadly rounded, distally sharply acute in lateral view, crenulate in dorsal view; supra-anal lobe thin, with scarcely any convexity where the denticles are situated. Titillators bilobed, outer lobe with strongly chitinised outwardly curving margin, which has an acute apex, and 3–4 minute denticles on an inner projecting bend; inner lobe narrow, feebly chitinised, ending in a minute spinule; outer and inner lobes connected by setulose membrane. ♀ unknown.

Fore-wing.—5.5 mm.

Colour as in *capensis*.

Locality.—French Hoek Pass (east side) (H. G. W., 1st October 1932, 1 ♂, 19th November 1933, 1 ♂, and 16th September 1934, 1 ♂).

Aphanicerca tereta n. sp.

Imago.—Venation and other characters as in *capensis*.

♂ *Genitalia*.—Dorsal process of IXth tergite divided into two lanceolate halves, each with a distal band of posteriorly directed spine-setae (not short conical spinules as in *capensis*), and 3–4 sharp denticles on inner distal margin. Dorsal plates of Xth tergite with

projecting anterior corner and somewhat acute posterior corner; supra-anal lobe slender, terete, curved, with a double row of stout conical spinules on the concave surface. Titillators (all specimens

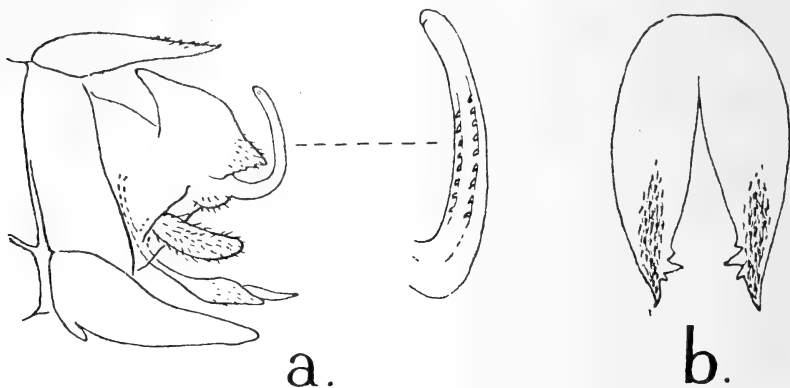


FIG. 13.—*Aphanicerca tereta* n. sp. a, lateral view ♂ genitalia, with supra-anal lobe further enlarged; b, dorsal view of dorsal processes of IXth segment.

have been set and dried and the genitalia rather mutilated) similar to those of *capensis*, but the outer margin is setulose instead of spinulose. ♀ unknown.

Fore-wing.—6.5 mm.

Colour as in *capensis*.

Locality.—River Zonder End Mts. (K. H. B., November 1928, 4 ♂♂).

Remarks.—Some ♀♀ obtained in the same locality resemble those of *capensis* var. γ , which also occurs there, so that it is uncertain to which species they belong.

Aphanicerca sp.

1931. Tillyard, *loc. cit.*, p. 121 (paratype ♀ from Lemoenshoek).

The subgenital plate of ♀ is similar to that of *capensis*, but the subanal plates are short and rounded. In this respect these ♀♀ differ from the normal *capensis*, but until ♂♂ are found at the same locality they should not be assigned to any particular species.

Aphaniceropsis n. g.

Imago.—Venation as in *Aphanicerca*. Wings rather strongly suffused, unicolorous, without clear patch in fore-wing.

IXth tergite ♂ without process, sternite elongate, with median process at base. Xth tergite with flat, shield-like chitinated area,

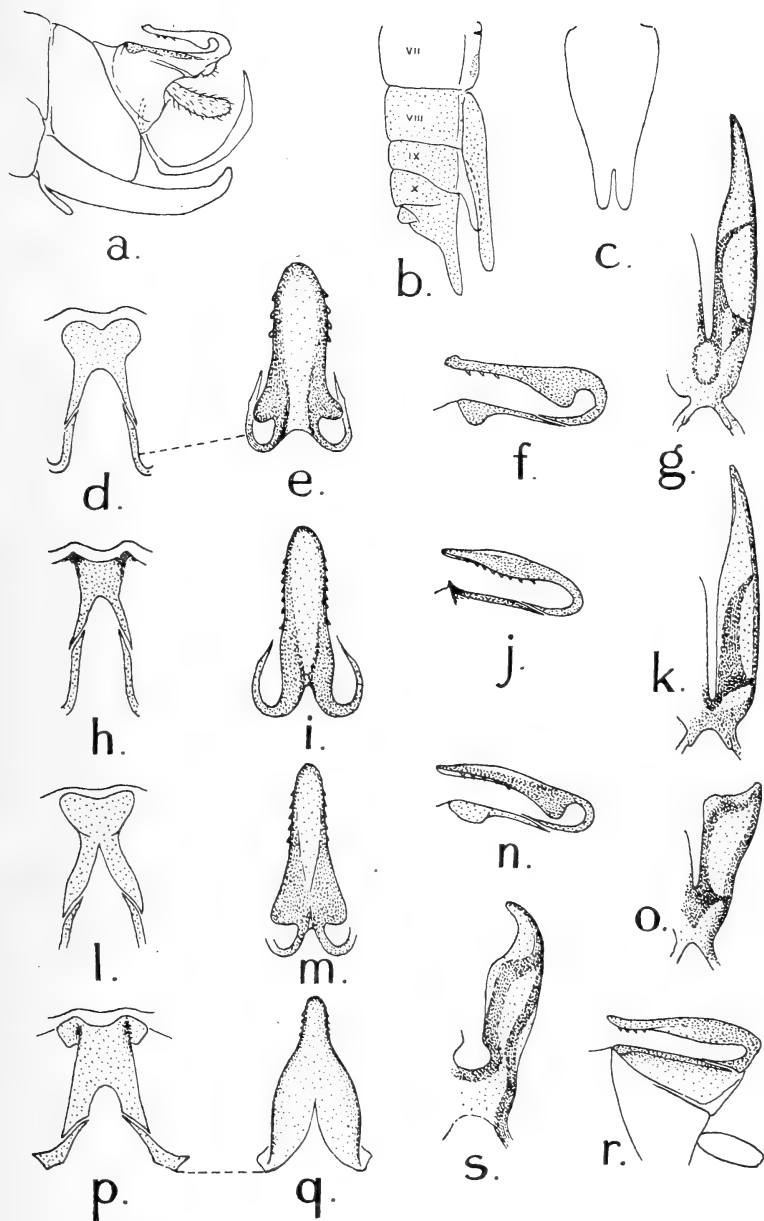


FIG. 14.—*Aphanicercopsis* n. g. *A. tabularis* n. sp. *a*, lateral view ♂ genitalia; *b*, lateral view ♀ genitalia; *c*, ventral view of subgenital plate ♀; *d*, dorsal view of dorsal plate of Xth segment; *e*, *f*, dorsal and lateral views of supra-anal lobe; *g*, titillators.
A. denticulata Tillyard. *h*–*k*, same parts as represented in *d*–*g*.
A. outeniquae n. sp. *l*–*o*, the same.
A. hawaquae n. sp. *p*–*s*, same parts; *r* shows the whole of Xth tergite and the pleurite with cercus, as in *a*.

divided into two arms posteriorly, and giving support to the chitinous framework of the recurved supra-anal lobe, which lies closely appressed to the tergite. Pleurites better marked than in *Aphanicerca*, but not disconnected, *i.e.* not freely movable or clasper-like. Titillators more or less elongate, with chitinous framework. In the resting position they curve upwards, and their tips lie in the groove at the hind end of the supra-anal lobe. Internal supporting struts slender, moderately long. Cerci as in *Aphanicerca*.

In ♀ abdominal segments VIII–X completely chitinated; segments II–VII with chitinated areas on sternites only. These latter segments have a trapezoidal plate or transverse band in posterior half, and a small transverse bar or spot on either side of the middle line in anterior half. Subgenital plate on VIIIth segment elongate-lanceolate. IXth sternite produced in a median membranous pointed process. Subanal plates triangular, rather elongate. Cerci very short, conical. Nymph as in *Aphanicerca*.

Remarks.—The subgenital plate and the subanal plates of the ♀ have the appearance of forming an ovipositor, but the act of oviposition has not been observed.

The chitination of the ♀ abdominal sternites II–VII is characteristic; even if the posterior bands are feebly developed, though those on segments II and VII are fairly constant, the two anterior bars or spots on each segment are present.

Genotype.—*Aphanicerella denticulata* Tillyard.

Aphaniceropsis denticulata (Tillyard).

1931. Tillyard, *loc. cit.*, p. 121, figs. 5, 6a.

Imago.—In fore-wing cross-vein Sc-R at or before junction of Sc with C. Fork of R_{2+3} and R_{4+5} sessile or stalked. 1A usually meets the margin in a high angle, as in Tillyard's figure of *barnardi*. The kink or bend in Cu_2 above 1A and margin rather strongly marked. In hind-wing fork of R_{2+3} and R_{4+5} sometimes with the fork shorter than the stalk.

♂ *Genitalia.*—Subgenital plate elongate, apically curved upwards, basal appendage very small, usually a mere knob. Dorsal plate of Xth tergite hour-glass shaped, the anterior corners strongly chitinated and forming upturned points. Supra-anal lobe narrow, linguiform, without lateral lobes at base, its dorsal surface convex (except posteriorly), margins with several stout conical denticles on their lower surface. Titillators elongate, lanceolate, with strong chitinous

supporting rod and membranous apex, the outer margin of which is slightly chitinated.

♀ *Genitalia*.—Subgenital plate forming an elongate spoon-shaped process, lanceolate when flattened out, tapering gradually to a bilobed apex, which is quite glabrous.

Fore-wing.—♂ 6–7 mm., ♀ 7–9 mm.

Nymph not distinguishable from that of *A. capensis*.

Localities.—Gt. Winterhoek Mts., Tulbagh (K. H. B., end August 1929, ♂♂, and September 1932, ♂♂♀♀; K. H. B. and H. G. W., November 1932, ♂♂♀♀).

Palmiet River, near Kleinmond (H. G. W., July 1932, 4 ♂♂, 1 ♀, and 2 apterous ♀♀).

Witte River, Wellington Mts. (H. G. W., October 1933, ♂♂♀♀).

French Hoek Pass (east side) (K. H. B., October 1933, 1 ♂, 2 ♀♀).

Aphanicercopsis tabularis n. sp.

Imago.—Venation and ♀ genitalia as in *denticulata*.

♂ *Genitalia*.—Subgenital plate with longer basal process than in *denticulata*. Dorsal plate of Xth tergite hour-glass shaped, but with broadly rounded anterior corners which do not form projecting knobs. Supra-anal lobe broader than in *denticulata*, with lateral basal lobes and fewer denticles; upper surface flat, usually with small apical knob. Titillators with the chitinous framework not so heavily chitinated as in *denticulata*.

Fore-wing.—♂ 3·5–5 mm., ♀ 5–7 mm. Exceptionally large specimens from Kirstenbosch measure ♂ 6–7 mm., ♀ 8–9 mm.

Colour as in *denticulata*.

Nymph, barring its smaller size, not differing from that of *A. capensis*. Subanal plates in ♀ nymphs nearing metamorphosis prominent, as they contain the subanal plates of the adult.

Localities.—Streams on slopes of Table Mt., Cape Town (K. H. B., July to October).

Nonna Kloof, Keeromberg, Worcester (K. H. B., September 1930, 1 ♂).

Remarks.—Very close to *denticulata*, but possessing four characters in the ♂ genitalia, any one of which is sufficient at a glance to distinguish the species.

Aphanicercopsis outeniquae n. sp.

Imago.—Venation as in *denticulata*.

♂ *Genitalia*.—Basal appendage of IXth sternite very well developed,

larger even than in *tabularis*. Dorsal plate of Xth tergite similar to that of *tabularis*, but anterior corners less broadly rounded. Supra-anal lobe narrow, resembling that of *denticulata* but with lateral basal lobes, upper surface convex, margins with several denticles. Titillators short, clavate, the strongly chitinated framework forming an oblong with clear centre; no long apical process.

♀ Genitalia (specimen extracted from nymph) as in *denticulata*.

Fore-wing.—♂ 5.5 mm.

Colour as in *denticulata*.

Nymph as in *A. capensis*.

Localities.—George (Government Forest area) (K. H. B., January 1931, 1 ♂ and ♂♀ nymphs).

Robinson Pass, Outeniqua Range (K. H. B., February 1932, 1 ♂).

Montagu Pass, George (H. G. W., April 1933, 1 ♂).

Aphaniceropsis hawaquae n. sp.

Imago.—Venation as in *denticulata*.

♂ Genitalia.—Basal appendage of IXth sternite as in *tabularis*. Dorsal plate of Xth tergite oblong, with ear-like projections anteriorly, the posterior arms broad, with small intervening excision. Struts supporting the supra-anal lobe short and stout, the lobe broad at base (posterior), narrowing rather abruptly to the apical portion where the denticles are situated. Titillators stout, shorter and broader than in *denticulata*, but longer than in *outeniquae*, with short incurved apical process. ♀ unknown.

Fore-wing.—6.5 mm.

Colour as in *denticulata*.

Localities.—Witte River, Wellington Mts. (H. G. W., September 1933, 3 ♂♂).

French Hoek Pass (east side) (H. G. W., 1st October 1932, 1 ♂, and K. H. B., 1st October 1933, 1 ♂).

Jonkershoek, Stellenbosch (K. H. B. and H. G. W., 10th June 1932, 1 apterous ♂).

Remarks.—A species easily distinguished by the supra-anal lobe and the titillators. For apterous ♂ see *supra*, p. 517.

Gen. *Aphanicerella* Tillyard.

1931. Tillyard, *loc. cit.*, p. 124 (subgen. of *Aphanicerca*).

Imago.—Venation as in *Aphanicerca* and *Aphaniceropsis*. Wings rather strongly suffused, without clear patch on fore-wing. IXth

tergite ♂ without process. IXth sternite short, with basal process. Dorsal area of Xth tergite with two oblong or subtriangular strongly chitinated plates (in one species coalesced into one plate), separated by a more or less triangular shield-like plate, and a transverse bar, to the ends of which is attached the supra-anal lobe. The latter is triangular or subtrapezoidal, projecting forwards and lying closely appressed to the dorsal surface between two small scabrous knobs, one on each dorsal plate. Pleurites deeply separated from the tergite, ending in sharp, strongly chitinated points, and capable of lateral movement. Titillators elongate, each half longitudinally grooved on upper surface, the membranous apex lying bent back in this groove in the resting position; often with supporting basal ear-like processes; internal supporting struts short. Cerci short, ovoid, apex with a clear space in which is a minute papilla, representing apparently the remnant of a 2nd joint.

In ♀ segments VII, IX, and X completely chitinated (VIIIth sternite sometimes incompletely so). Segments II–VI with more or less well-developed chitinous areas on sternites only. Segment VIII completely membranous, except in one species (*nigra*), where there are small pleural chitinous areas. Subgenital plate on VIIth segment more or less strongly chitinated, not elongate, often gibbous. Subanal plates rounded. Cerci short, conical.

Nymph as in *A. capensis*, but more setose; some long setae on thorax, abdomen, and legs in addition to the ordinary short ones.

Genotype.—*A. barnardi* Tillyard.

Remarks.—The species of this genus are mostly smaller and darker than those of *Aphanicerca*, and like the *Aphanicercopsis* species they have no clear patch on the fore-wing. The movable pleurites of the ♂, which act as claspers, and the subgenital plate of the ♀ on the VIIth segment are the characteristic features.

Tillyard designated *barnardi* as the type of his subgenus because both sexes were known. This designation holds good, although the supposed female of the type-species proves to have been wrongly assigned.

Aphanicercella barnardi Tillyard.

1931. Tillyard, *loc. cit.*, p. 122, figs. 6b, 7, 8 (♂ only; not the ♀, fig. 9).

Imago.—Position of cross-vein Sc-R in fore-wing is variable, not always before end of Sc.

♂ *Genitalia*.—Subgenital plate in ventral view broader than long

(but see p. 512), lateral margins often sinuous, producing a definite though blunt median point; basal process moderately large. Supra-anal lobe triangular with subacute apex, hinged at the posterior chitinised ends of the lateral margins to a crescentic transverse plate; in front of this a triangular plate lying between the oblong dorsal

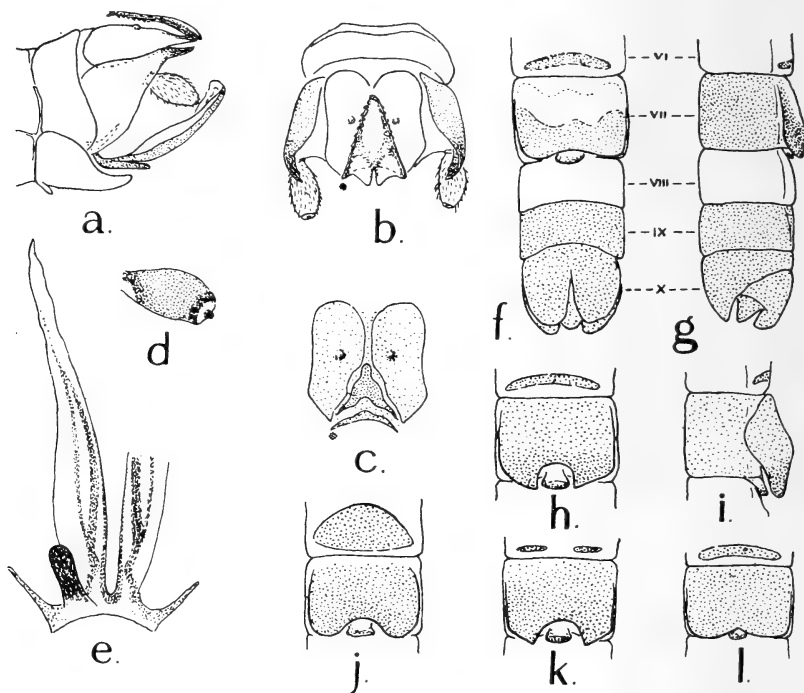


FIG. 15.—*Aphanicercella barnardi* Tillyard. *a, b*, lateral and dorsal views genitalia of ♂ from Fairy Glen (typical form); *c*, dorsal view of dorsal plates of Xth segment, with interpolated plate and transverse bar, to the ends of which the supra-anal lobe is attached; *d*, cercus; *e*, ventral view of titillators of Table Mt. form, the basal supporting process on right half omitted; *f, g*, ventral and lateral views of end of abdomen of ♀ from Fairy Glen (typical form); *h, i*, subgenital plate (segment VII) ♀ from Table Mt.; *j, k, l*, the same, from Jonkershoek, Palmiet River, and Schoester's River (Cape Peninsula) respectively.

plates of the Xth tergite. Lateral margins of the supra-anal lobe with serrations on lower surface pointing towards base of lobe (not forwards as in Tillyard's figure); in side view the apex of the lobe may be slightly thickened, but never with recurved hook on lower surface. Titillators elongate, chitinised framework as figured, the two main struts being approximately of the same thickness; basal supporting processes well developed, apices rounded. Pleurites

triangular, upper posterior corner produced in a sharp, strongly chitinised, somewhat incurved point, often sub-bifid. Cerci short, ovate, apex subtruncate, pale, with minute papilla, a small area at base on ventral side also pale.

♀ *Genitalia*.—VIIth sternite (subgenital plate) strongly chitinised only in its posterior half, the anterior limit variable, the hind margin with shallow though variable median excavation. Posterior margins of each of sternites III–VI with narrow transverse band, sometimes interrupted in the middle; IIInd sternite more or less completely chitinised.

Fore-wing.—♂ 5–5.5 mm., ♀ 6–6.5 mm.

Colour as given by Tillyard.

Nymph, as stated under the genus, does not differ from that of *A. capensis* (barring size), except in being more setose (see fig. 8, i).

Localities.—Fairy Glen, Brandwacht, Worcester (K. H. B., 4th June 1929, ♂♂; K. H. B. and H. G. W., August 1932, ♂♂♀♀, some in copula) (typical form).

Nonna Kloof, Keeromberg, Worcester (K. H. B., September 1930, ♀♀).

In other localities certain variations occur, but they are scarcely great enough to justify definite names, and, moreover, are connected by more or less transitional forms. In all of them the structure of the Xth tergite ♂ is the same.

Var. a.—♂ titillators with the inner supporting rod much stronger than the outer, the basal supporting process more slender. Supra-anal lobe with distinct recurved tip on lower surface.

♀ IIInd and VIIth sternites fully chitinised, intervening sternites with rather strong transverse bands; hind margin of VIIth sternite slightly excised.

Localities.—Cape Peninsula, Lakeside Plateau (upper reaches of the Silvermine stream) (A. C. H., July 1933, ♂♀); middle reaches of Silvermine stream (A. C. H., 1931, ♂♂♀♀); Schoester's River (A. C. H., August 1930, ♀); Glencairn Valley (K. H. B. and H. G. W., August 1932, ♂♂♀♀, some in copula, nymphs).

Gt. Winterhoek Mts., Tulbagh (K. H. B., September 1932, ♂♂♀♀, some in copula).

Var. β.—♂ as in *a*. Apex of supra-anal lobe slightly enlarged, knob-like. ♀ IIInd sternite nearly completely chitinised, the transverse bands on segments III–VI more or less interrupted medianly. VIIth sternite fully and strongly chitinised, rather strongly gibbous, its hind margin with deep subquadrate excision.

Localities.—Kasteel's Poort, Skeleton Ravine, and other ravines on Table Mt., Cape Town (K. H. B. and H. G. W., various dates June to November, ♂♂♀♀, many in copula, nymphs).

Witte River, Wellington Mts. (H. G. W., October 1933, ♂♂♀♀).

Var. γ.—♂ titillators as in typical form, but basal supporting processes more slender; apex of supra-anal lobe with recurved hook. ♀ IInd–VIth sternites with broad lenticular chitinous patch covering nearly whole of sternite; VIIth sternite nearly fully chitinised, its hind margin with semicircular excision between rounded lobes.

Locality.—Jonkershoek, Stellenbosch (K. H. B., July 1927; K. H. B. and H. G. W., June 1932, ♂♂♀♀).

Var. δ.—♀ IInd sternite nearly fully chitinised; IIIrd–VIth sternites with interrupted narrow transverse bands; VIIth sternite fully chitinised, slightly gibbous, hind margin with semicircular excision between pointed lobes. ♂ unknown.

Locality.—Palmiet River (H. G. W., July 1932, 1 ♀).

Aphanicercella scutata n. sp.

Imago.—Venation as in *barnardi*.

♂ *Genitalia*.—Subgenital plate and basal process as in *barnardi*. Supra-anal lobe triangular with blunt subtruncate apex, hinged posteriorly to a narrow transverse bar; in front of this a crescentic plate between the two dorsal plates of the Xth tergite, each of which has a sinuous lateral margin. Lateral margins of supra-anal lobe with very fine and close-set serrations. Pleurites as in *barnardi*. Titillators as in *barnardi*, but the basal supporting processes apically acute. Cerci ovate, the basal half chitinised only on upper side so that at first sight the cerci appear petiolate.

♀ *Genitalia*.—IInd sternite nearly fully chitinised; transverse bands on sternites III–VI nearly obsolete; VIIth sternite strongly and completely chitinised, gibbous, especially the two distal lobes, between which is a semicircular excision.

Fore-wing.—♂ 5 mm., ♀ 6 mm.

Colour as in *barnardi*.

Localities.—Witte River, Wellington Mts. (H. G. W., September 1933, 1 ♂, 3 ♀♀). French Hoek Pass (east side) (H. G. W., October 1932, 1 ♀).

Remarks.—The Xth tergite and supra-anal lobe of ♂ clearly separate this species from *barnardi*; the ♀ bears a strong resemblance to the Table Mt. form of the latter species. The sexes are assumed to be conspecific, but were not actually caught in copula.

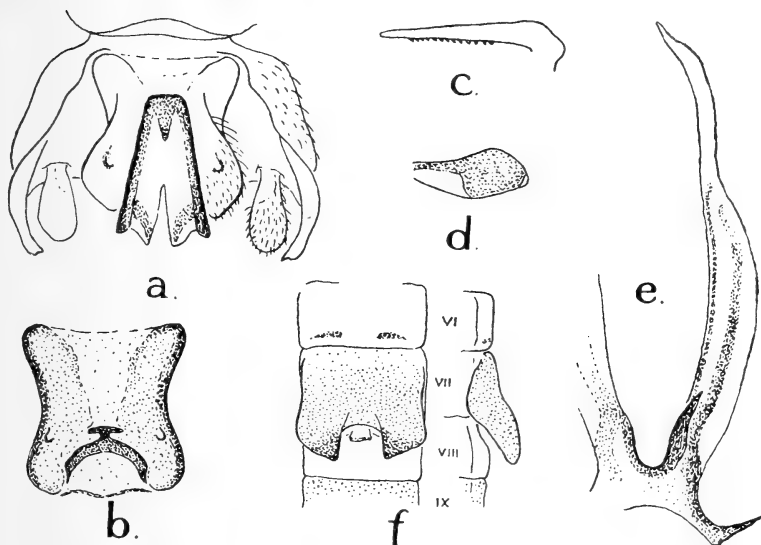


FIG. 16.—*Aphanicercella scutata* n. sp. *a*, dorsal view ♂ genitalia; *b*, dorsal view of dorsal plates of Xth segment, with interpolated plates; *c*, lateral view of supra-anal lobe; *d*, cercus; *e*, ventral view of titillators, basal process on left side omitted; *f*, ventral and lateral views of segments VI-IX ♀.

Aphanicercella cassida n. sp.

Imago.—Venation as in *barnardi*.

♂ *Genitalia*.—IXth sternite of usual shape, but with very large basal process extending to middle of sternite. Supra-anal lobe

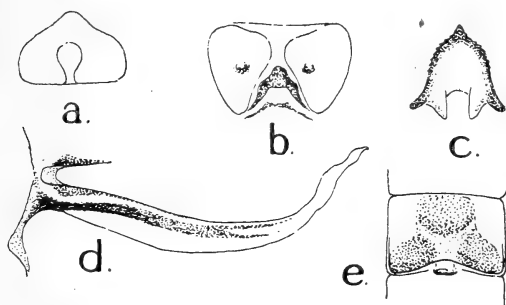


FIG. 17.—*Aphanicercella cassida* n. sp. *a*, IXth sternite ♂; *b*, dorsal plates of Xth tergite; *c*, supra-anal lobe; *d*, titillator; *e*, subgenital plate (VIIIth sternite) ♀.

helmet-shaped, with small acute apical point; basal excision wide, hinged to a crescentic bar, in front of which is a triangular plate, as in *barnardi*, but the apex blunter and the arms more widely divergent.

Dorsal plates of Xth tergite shorter and broader than in *barnardi*. Titillators with a single broad supporting rod, apically bifid, and basally strongly chitinised; no basal supporting processes. Pleurites and cerci as in *barnardi*.

♀ *Genitalia*.—IIInd sternite fully but not strongly chitinised; transverse bars on sternites III–VI obsolete; VIIth sternite with trilobate chitinised area, hind margin slightly excavate.

Fore-wing.—♂ 6 mm., ♀ 7 mm.

Colour as in *barnardi*.

Locality.—Kaaiman's Gat, near Wilderness, George District (H. G. W., 16th April 1933, 1 ♂, 3 ♀♀).

Remarks.—A species with distinctive supra-anal lobe. The sexes were not caught in copula.

Aphanicerella bifurcata n. sp.

Imago.—Venation as in *barnardi*.

♂ *Genitalia*.—IXth sternite with basal process larger than in *barnardi*, but not as large as in *cassida*. Dorsal plates of Xth tergite

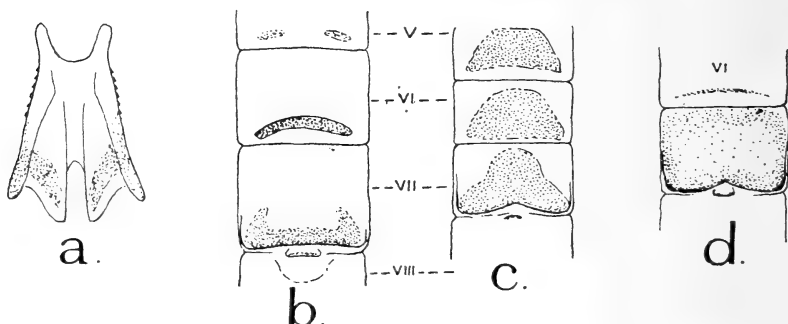


FIG. 18.—*Aphanicerella bifurcata* n. sp. *a*, supra-anal lobe; *b*, ventral view of abdominal segments V–VIII ♀ from River Zonder End Mts.; *c*, the same from Gt. Winterhoek Mts.; *d*, segments VI–VIII of ♀ from Montagu Pass.

as figured for *quadrata* (fig. 19, *a*). Supra-anal lobe anteriorly bifurcate, the distance between the horns more than twice in the length of lateral margin, which is slightly convex where the serrations are situated. Titillators without basal supporting process, the outer strut well developed, the inner usually only developed distally, often with a slight prolongation into the membranous apex (*cf. cassida*, fig. 17, *d*). Pleurites and cerci as in *barnardi*.

♀ *Genitalia*.—IIInd sternite nearly completely but feebly chitinised; transverse bars on sternites III–V obsolete, but that on VI usually

distinct; VIIth sternite with chitinated bar on hind margin, the ends laterally projecting a little forwards, hind margin straight.

Fore-wing.—♂ 5.5 mm., ♀ 6-6.5 mm.

Colour as in *barnardi*.

Localities.—Oudebosch, River Zonder End Mts., 1500-3500 feet (K. H. B., January 1919, 1 ♀, and November-December 1928, ♂♀ in copula; H. G. W., January 1933, ♂♂♀♀; K. H. B. and H. G. W., January 1934, ♂♂♀♀).

Tradouw Pass, Langeberg Range, near Swellendam (K. H. B., October 1925, 2 ♂♂, 2 damaged ♀♀).

The following local variations occur in the chitination of the ♀ sternites, though the ♂♂ do not differ from the above.

Var. α.—VIIth sternite with chitinated band around all margins, feeblest on anterior margin; transverse bar on VIth sternite very feeble.

Locality.—Montagu Pass, Outeniqua Mts., George (H. G. W., 14th April 1933, ♂♂♀♀).

Probably also George (Government Forest area) (K. H. B., January 1931, 1 ♂).

Var. β.—All sternites II-VII with strongly chitinated trapezoidal area, that on sternite VII somewhat trilobate.

Localities.—Gt. Winterhoek Mts., 4000-5000 feet (K. H. B., September 1932, ♂♂♀♀).

Matroosberg, Hex River Mts. (northern slopes on Ceres side), 6000 feet (K. H. B., September 1933, ♂♀♀).

Aphanicerella quadrata n. sp.

Imago.—Venation as in *barnardi*.

♂ *Genitalia*.—Resembling *barnardi* in the IXth sternite and titillators, but the latter without basal supporting processes. Dorsal plates of Xth tergite intermediate between those of *barnardi* and *cassida*. Supra-anal lobe subquadrangular, the anterior margin excised, the distance between the horns one-half the length of lateral margin, lateral margins subparallel, straight, with minute serrations.

♀ *Genitalia*.—Subgenital plate strongly chitinated, except near anterior margin, hind margin with wide semicircular excision. IIInd sternite not strongly chitinated, transverse bands on sternites III-V obsolete, a faint bar on sternite VI.

Fore-wing.—♂ 5 mm., ♀ 6 mm.

Colour as in *barnardi*.

Locality.—Cedar Mts., Clanwilliam District, 4000–5000 feet (K. H. B., September 1923, 2 ♂♂, 2 ♀♀).

Remarks.—It is perhaps doubtful whether this is not merely an extreme variation of *bifurcata*. It is, however, very distinct both in

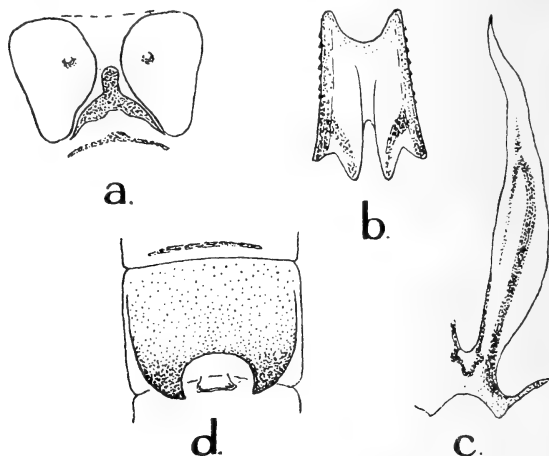


FIG. 19.—*Aphanicercella quadrata* n. sp. a, dorsal plates of Xth tergite; b, supra-anal lobe; c, titillator; d, abdominal segments VI–VIII ♀.

the supra-anal lobe of ♂ and VIIth sternite of ♀, and may for the time being stand as a distinct species. The sexes were not caught in copula.

Aphanicercella nigra n. sp.

Imago.—Venation as in *barnardi*.

♂ *Genitalia*.—IXth sternite with large basal process, almost as large as in *cassida*. Dorsal plates of Xth tergite fused into a single transverse plate, together with the interpolated piece, but leaving two clear membranous triangular patches. Supra-anal lobe sub-quadrangular, basal width equal to lateral margin, with deep angular excision anteriorly, projecting posterior lobes very minutely setulose. Titillators as in *scutata*, but the ends of the supporting rods more strongly chitinised, basal supporting processes acute. Pleurites as in *barnardi*. Cerci appearing petiolate as in *scutata*.

♀ *Genitalia*.—IIInd sternite fully chitinised, transverse bands on IIIrd–VIth sternites obsolete. A transverse band on the nearly straight hind margin of VIIth sternite. Vulva wide. VIIIth segment with small pleural chitinous patch on either side, otherwise membranous.

Fore-wing.—♂ 6 mm., ♀ 7 mm.

Colour.—Head and thorax very dark vandyke brown, almost black. Wing membranes by reflected light almost black, by transmitted light very strongly suffused; a clear (white) narrow longitudinal streak in the space between Rs and MA, beginning near junction of MA with Rs and extending to just beyond anastomosis, the cross-vein R_{4+5} -MA₁ being interrupted; a second clear streak following the

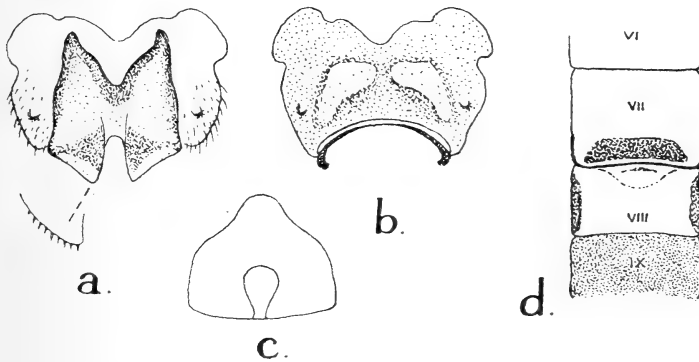


FIG. 20.—*Aphanicercella nigra* n. sp. a, supra-anal lobe; b, dorsal plates of Xth tergite; c, subgenital plate (IXth sternite) ♂; d, ventral view of abdominal segments VI-IX ♀.

course of Cu_2 on its lower (anal) side from base nearly to apex; similar clear streaks, but less conspicuous, on hind wing. Abdomen castaneous, the chitinised portions dark vandyke brown.

Eggs ovoid, .2 mm. long diameter, without sculpture or micropylar projection.

Locality.—French Hoek Pass (east side) (K. H. B., 1st October 1933, 1 ♂, 3 ♀♀; H. G. W., 8th October 1933, 1 ♂, 1 ♀).

Remarks.—A very distinctive species both on account of its coloration and the ♂ and ♀ genitalia. Although not caught in copula, there is no doubt in this case that the sexes are conspecific. The width of the vulva is evidently correlated with the width of the supra-anal lobe; and the fusion of the dorsal plates of the Xth tergite may help to give more support to this accessory copulatory structure.

The clear streaks on the wings are not peculiar to this species, being present in all the South African Nemourines; but here they are very conspicuous owing to the very deep suffusion of the wing membranes.

While some of the other species of this genus, and of *Aphanicercopsis*, are of a deep brown colour, sometimes very dark brown

(the colour fades in dried or alcoholic material), this species is nevertheless outstanding in its almost black coloration. In the field the flies appear quite black.

Gen. *Desmonemoura* Tillyard.

1931. Tillyard, *loc. cit.*, p. 126.

Imago.—♂ like *Aphanicerella*, but with elongate IXth sternite, well demarcated pleurites, each with a long falcate process, and elongate falcate (but single-jointed) cerci.

♀ like *Aphanicerca*, but cerci better developed. The subgenital plate is on VIIIth segment, and there is a saddle-like area on the VIIth sternite; both this and the subgenital plate more strongly chitinised than the rest of their respective segments, but not as strongly as the IXth and Xth tergites. Sternites II–VI and IX and X membranous, and without transverse bars.

Wings banded alternately with light and dark.

Eggs.—*Infra*, p. 548.

Nymph not differing from that of *Aphanicerca*.

Genotype.—*D. pulchellum* Tillyard.

Remarks.—The main character relied upon in the institution of this genus, viz. the common stalk of Rs and M, proves to be accidental; out of many specimens examined it occurs only in the holotype ♂. Moreover, by an unfortunate error, due apparently to the mix-up of abdomens during preparation and mislabelling of the microscope slides, the true ♀ of *Desmonemoura* was described as that of *Aphanicerella barnardi*. The description given for the ♀ of *Desmonemoura* was taken from dried specimens (there is no ♀ mounted on a slide labelled as *Desmonemoura*), and is valueless.

In contrast with the preceding genera, the several species of which each have apparently a somewhat limited distribution, only one widely distributed species of *Desmonemoura* has up to the present been discovered.

Desmonemoura pulchellum Tillyard.

(The Porcupine Stone-fly.)

1931. Tillyard, *loc. cit.*, p. 126, figs. 10, 11, and 9 (♀ ascribed to *A. barnardi*).

Imago. ♂ *Genitalia*.—IXth tergite produced backwards over Xth tergite in two processes with strongly chitinised, somewhat knobby apices. IXth sternite elongate-triangular. Supra-anal lobe scimitar-like in lateral view, linguiform in dorsal view, bearing 5–6 denticles

on each side, folding down over the two dorsal plates of Xth tergite, each of which has a small chitinous knob; the chitinised lateral margins of the lobe are curved round and continued as two rods between the chitinised inner margins of the dorsal plates. Titillators rather stout, fused in their basal half, apices abruptly narrowed. Cerci setose, but the falcate processes of the pleurites are glabrous.

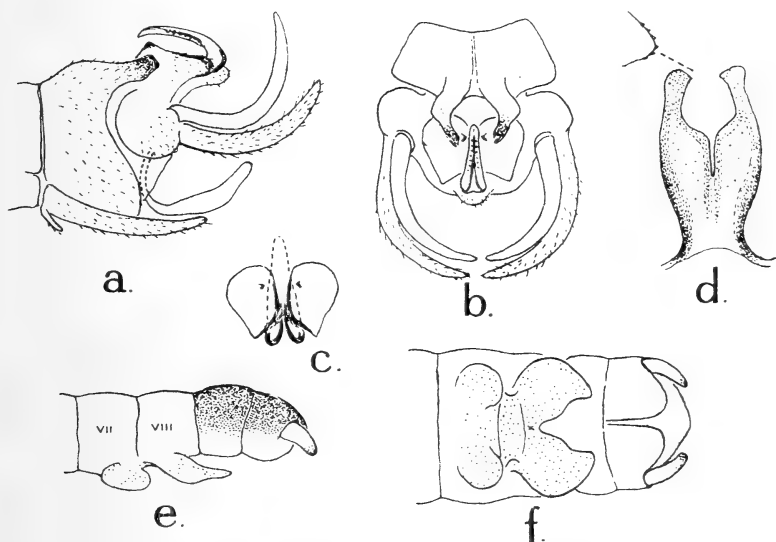


FIG. 21.—*Desmonemoura pulchellum* Tillyard. *a*, *b*, lateral and dorsal views ♂ genitalia; *c*, dorsal plates of Xth segment, the outline of the supra-anal lobe dotted; *d*, titillators; *e*, *f*, lateral and ventral views of abdominal segments VII–X ♀.

♀ *Genitalia* (cf. Tillyard's figure 9 as *A. barnardi*).—VIIth sternite with transverse oval patch rather more strongly chitinised than the rest of segment, the lateral portions rather gibbous and the central portion concave, hence saddle-shaped. Subgenital plate on VIIIth segment bilobate, with deep triangular excision, apices rounded. Cerci cylindrical, shorter than in ♂, but longer than in the other genera.

Fore-wing.—♂ 6 mm., ♀ 7–8 mm.

Colour.—Upper surface of head, meso- and meta-thorax blackish. Basal joints of antennae pale, subsequent joints brown, distal joints dark brown. Upper surface of prothorax lemon-yellow, of abdomen pale yellowish-brown. Lower surface of head, thorax, and abdomen pale yellowish-white. Genitalia brown. Wings banded with black

and pale lemon-yellow. (The black fades in dried or alcoholic specimens.)

Egg.—As in the other genera, but a trifle narrower in proportion to its length (width $\frac{2}{3}$ instead of $\frac{2}{5}$ the length).

Nymph as in *Aphanicerca capensis*.

Localities.—Banhoek, Stellenbosch (K. H. B., 7th October 1929, 1 ♂, 1 ♀).

Gt. Winterhoek Mts., Tulbagh, 3000–5000 feet (K. H. B., November 1917,* 2 ♂♂, 1 ♀; and K. H. B. and H. G. W., November 1932, ♂♂♀♀).

Hex River, Worcester (A. C. H., 5th October 1931, 1 ♀).

Tradouw Pass, Langeberg Range (K. H. B., October 1925, 3 ♀♀).

Oudebosch, River Zonder End Mts., 1500 feet (H. G. W., December 1931, 4 ♀♀, and January 1933, 1 ♀; K. H. B. and H. G. W., January 1934, 9 ♀♀).

Hottentots Holland Mts., 2500 feet (east side of Sugar Loaf) (K. H. B. and H. G. W., November 1932, 1 ♂).

Groot Drakenstein (K. H. B. and H. G. W., October 1933, ♂♂ and nymphs).

Remarks.—The holotype ♂ shows Rs and M with common stalk as in Tillyard's figure 10. Another mounted specimen, sex not stated, has Rs joined to R by a right-angled bend as in *Aphanicerca*. All other specimens which I have examined agree with the latter. The common stalk of Rs and M in the one specimen chosen as the holotype, therefore, was accidental, and this character must be omitted from the generic diagnosis.

The ♂ specimens from which the present figures of the genitalia are drawn appear to agree in all respects with the holotype slide from which Tillyard's figure 11 was drawn. The latter is squashed flat dorso-ventrally, and the true identification and position of the various parts without previous examination "in the round" would be almost impossible.

The ♀♀ from all the above localities agree in all respects one with another and with Tillyard's figure 9. In the Gt. Winterhoek Mts. (November 1932) a pair was found in copula entangled in a spider's web, which finally settles any doubt as to the correct ♀ of *Desmone-moura*. Unfortunately the actual mode of copulation and position of the ♂ copulatory structures could not be determined.

* The date should really be 1916.

18. *New South African Opiliones.*

By R. F. LAWRENCE, B.A., Ph.D., Assistant in Charge of Arachnida.

(With 19 Text-figures.)

THE following paper consists of descriptions of new Harvest-spiders which have accumulated since the publication of The Harvest-spiders of South Africa in 1931. I am indebted to Dr. S. Manton of Cambridge for two new species collected at Hogsback, Amatola Mts., in May 1933, one of which, *Larifuga mantoni*, is named in her honour. Mr. J. Hewitt, Albany Museum, Grahamstown, has sent me two new forms, which are described here.

Three new genera have been established, *Umtaliella*, *Paramontia*, and *Roewerania*, the last of which is named in honour of my friend Professor C. Fr. Roewer, Director of the Natural History Museum, Bremen. The remaining species are included in already known genera as follows:—

<i>Ceratontia</i>	.	.	.	.	8 species.
<i>Austromontia</i>	.	.	.	.	2 „
<i>Biacumontia</i>	.	.	.	.	1 „
<i>Adaeulum</i>	.	.	.	.	1 „
<i>Larifugella</i>	.	.	.	.	1 „
<i>Larifuga</i>	.	.	.	.	1 „
<i>Cadella</i>	.	.	.	.	1 „
<i>Rhampsinitus</i>	.	.	.	.	1 „

All types, except where otherwise stated, are deposited in the South African Museum, Cape Town.

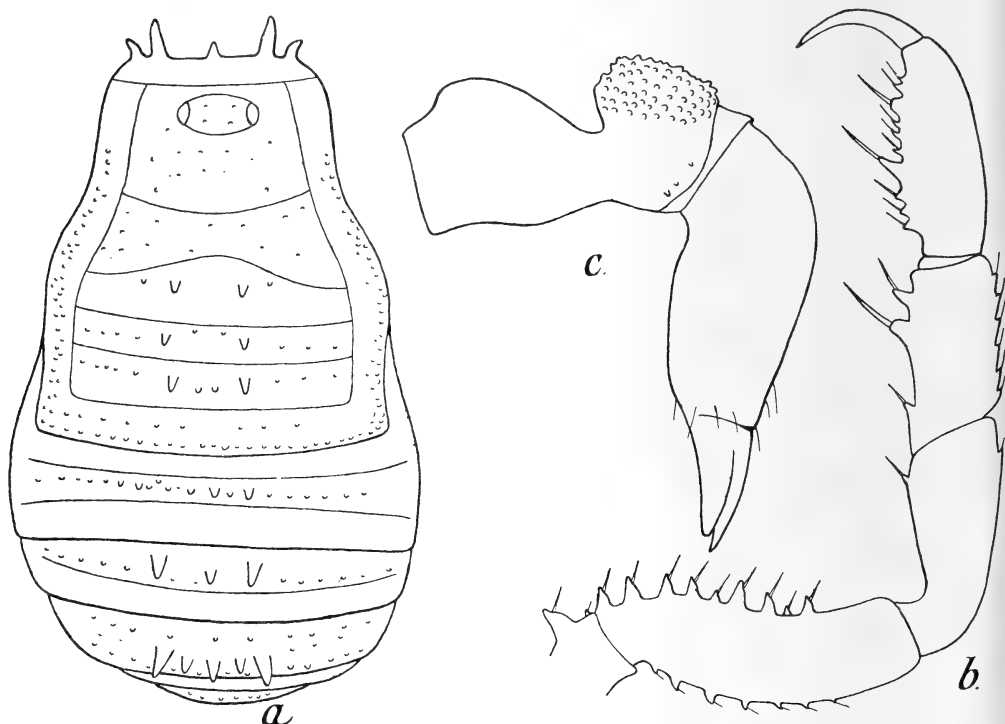
SUBORDER LANIATORES.

FAM. **ASSAMIIDAE** Sorensen.SUBFAM. **Assamiinae** Roewer.

UMTALIELLA n. genus.

Ocular tubercle low, broader than long, separated from the anterior margin of the carapace by a groove; dorsal scute without enlarged

granules, area I without a longitudinal groove, free tergites II and III with enlarged conical granules; stigmata clearly visible; pedipalp femur armed ventrally with a row of teeth shorter than the width of the femur seen from the side; chelicera with a deep saddle-shaped depression in the middle of segment I; legs unarmed; claws of legs III and IV simple, not toothed; terminal section of tarsus II, 3-jointed; tarsal segments I, 6; II, 9-10; III, 7; IV, 7.



TEXT-FIG. 1.—*Umtaliella rhodesiensis*. *a*, dorsal surface; *b*, pedipalp; *c*, chelicera.

Umtaliella rhodesiensis n. sp.

(Text-fig. 1.)

Type, 1 specimen (sex ?), Umtali, South Rhodesia.

Colour.—Uniform yellow (the specimen has been preserved for some years in alcohol).

Ocular tubercle seen from above (fig. 1, *a*), oval, its width greater than its length; seen from the side, low, rounded, and inconspicuous, surmounted by a few granules; dorsal scute (fig. 1, *a*), shiny and for

the most part smooth, with a few small scattered granules, free tergites II and III with 3 conical enlarged granules in the centre, the middle one smaller than the others, remaining granules of tergites minute; inferior surfaces of coxae with a uniform, fairly dense covering of minute granules, those at the distal extremities of the segments a little larger, especially in I and II; genital operculum with fewer and more scattered granules than the coxae; stigma-bearing sternite with several rows of minute granules, remaining sternites with 1 anterior row of minute granules.

Pedipalp as in fig. 1, *b*, seen from the inner side; femur ventrally with a row of 7-9 small triangular teeth, 2 denticles at its inner apex; patella ventrally with 1 outer, 2 inner small teeth; tibia ventrally on its inner side with 1 small, 1 large, 2 small, 1 large, 1 small teeth; outer side as in fig. 1, *b*; tarsus with 2 small, 1 large, 1 small, 1 large, 1 small teeth on its inner side; outer side as in fig. 1, *b*.

Chelicera seen from the inner side as in fig. 1, *c*; segment I seen from above granular in its distal half, smooth in its proximal half; segment II smooth, the movable and immovable claws long and slender.

Legs with rows of minute spines, a pair of longer ones at the inferior apex of the calcaneus of each leg; tarsal segments I, 6; II, 9-10; III, 7; IV, 7.

Dimensions.—Length of body * 6.2, breadth 3.9, pedipalp 3.5 mm.

FAM. **TRIAENONYCHIDAE** Sorensen.

SUBFAM. **Triaenonychinae** Pocock.

Genus **CERATOMONTIA** Roewer.

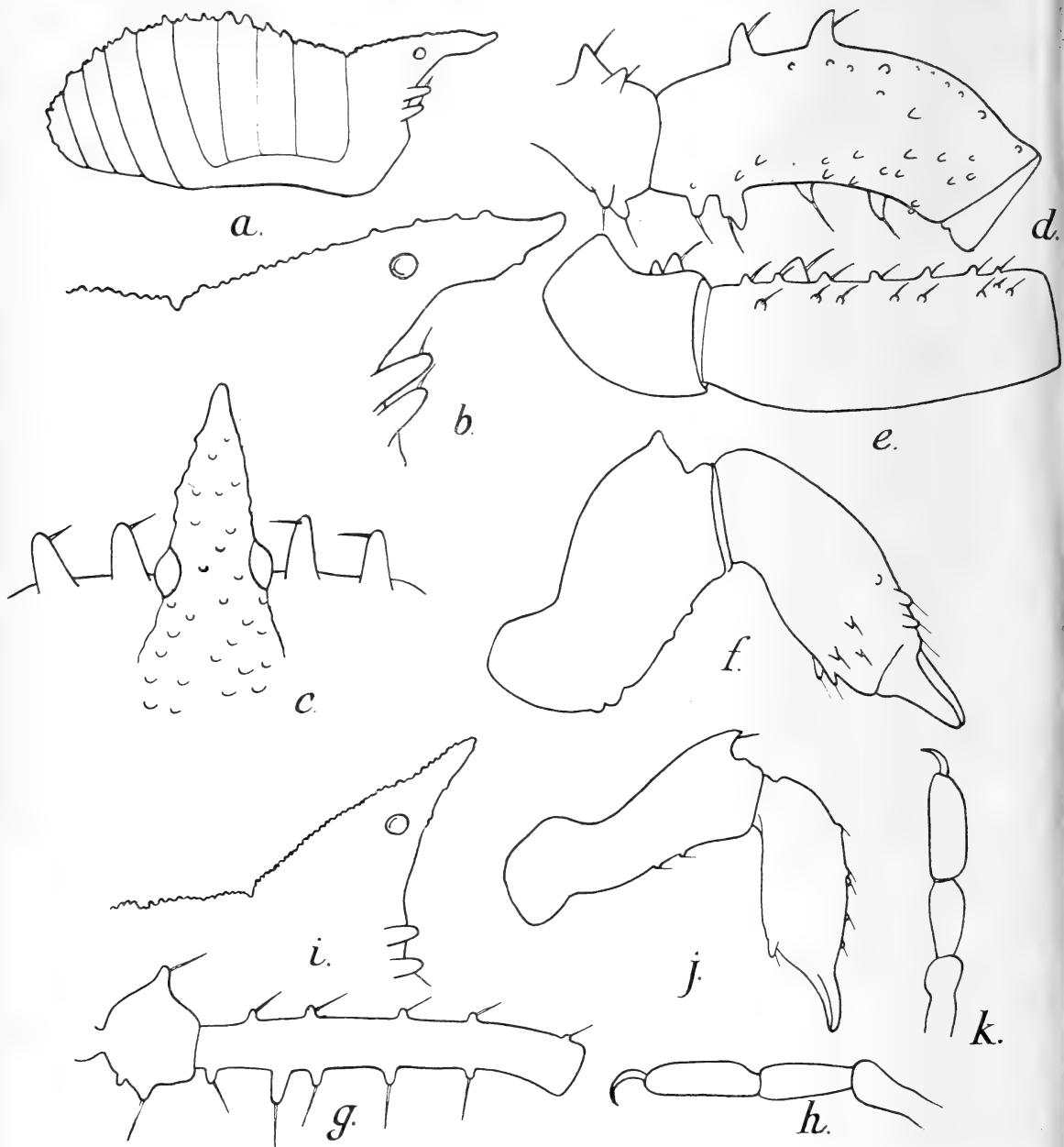
Ceratontia reticulata n. sp.

(Text-fig. 2.)

Types, 6 ♂♂, 3 ♀♀, Hogsback, Amatola Mts.

♂. *Colour*.—Carapace yellow-brown with black reticulate markings, remainder of dorsum uniformly dark brown except for a median black longitudinal stripe on dorsal scute; inferior surfaces of coxae with black reticulate markings, sternites blackish-brown; pedipalps

* "Length of body" is measured from the anterior margin of the carapace to the posterior extremity of the body.



TEXT-FIG. 2.—*Ceratontia reticulata*. ♂: *a*, profile of body; *b*, ocular tubercle from the side; *c*, ocular tubercle from above; *d*, pedipalp femur from inner side; *e*, patella and tarsus, inner side in profile; *f*, chelicera; *g*, femur I; *h*, tarsus I. ♀: *i*, ocular tubercle from the side; *j*, chelicera; *k*, tarsus I.

yellow with blackish reticulate bands; chelicerae covered with black reticulate markings; legs blackish-brown.

Dorsal Surface.—Anterior margin of carapace with 2 long conical granules on each side of the ocular tubercle (fig. 2, *b*, *c*); ocular tubercle as in fig. 2, *a*, *b*, seen from the side, fig. 2, *c*, seen from above; area behind the ocular tubercle with fairly numerous granules, a longitudinal strip in the middle smooth; areas I–IV with an anterior row of large and a posterior row of small granules, the anterior rows of areas I and II abbreviated, consisting of 2–4 granules, the central pair of granules in areas III and IV slightly larger than the others; area V and free tergites I and II with a single row of larger granules, III with a similar row duplicated at the sides.

Ventral Surface.—Coxae smooth and shiny, IV shagreened in its distal fifth, coxa I with 2 low tubercles, the distal one bifid and larger than the other; genital operculum longer than broad; sternites with 2 rows of small granules.

Pedipalp.—Femur and trochanter as in fig. 2, *d*; femur dorsally with only 2 teeth, armed ventrally as in fig. 2, *d*, without a strip of fine granulation in the middle, instead with a number of scattered, shiny, moderate-sized granules; remaining segments of palp weakly armed, patella unarmed on its outer side, with 2 small teeth on its inner side below (fig. 2, *e*); tibia armed on its inner side as in fig. 2, *e*, on its outer side with a row of small weak teeth; tarsus on its inner side with 4 moderate teeth, on its outer side with a row of about 10 teeth, two of which are large and triangular, the rest equal-sized and small.

Chelicera.—Segment I without teeth above but with 1–2 blunt shiny granules at its dorsal distal edge (fig. 2, *f*).

Legs.—Femur I below with a row of conical granules as in fig. 2, *g*; tarsal segments I, 2; II, 3; III, 3; IV, 3; tarsus I with its proximal segment very little shorter than the distal one (fig. 2, *h*).

Dimensions.—Length of body 3·8, breadth 3, pedipalp 4·9 mm.

♀. Differing from the ♂ in the shape of the ocular tubercle (fig. 2, *i*); areas I–IV with irregularly disposed granules, these not arranged in two rows.

Pedipalp.—Femur with 3 teeth above, tibia with a large basal tooth below on its inner side, tarsus below with larger teeth on each side than in the ♂. Chelicera as in fig. 2, *j*.

Legs.—Femur I with some conical granules below; tarsus I with the proximal segment $\frac{2}{3}$ the length of the distal segment (fig. 2, *k*).

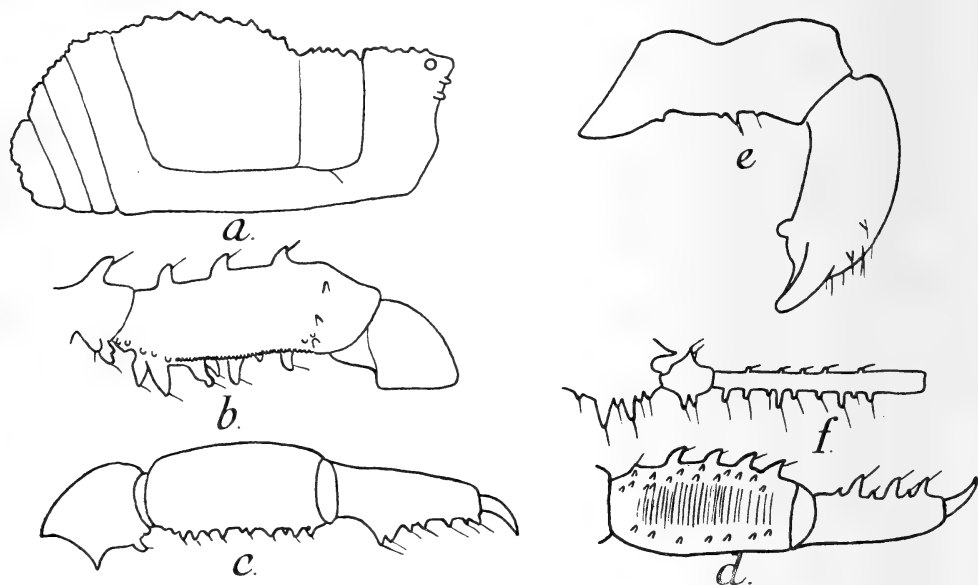
Dimensions.—Length of body 2·8, pedipalp 3·2 mm.

Ceratontia sanguinea n. sp.

(Text-fig. 3.)

Types, 12 ♂♂ and ♀♀, Montagu Pass, George.

♂. Colour a distinctive light red, except the legs, which are dark reddish-brown.

Dorsal Surface.—Body large, very broad and stout. The general background of the dorsum smooth and shiny, not shagreened, the

TEXT-FIG. 3.—*Ceratontia sanguinea*. ♂: *a*, profile of body; *b*, femur and patella of pedipalp; *c*, patella, tibia, tarsus of pedipalp, outer side in profile; *d*, tibia and tarsus of pedipalp, inner side in profile; *e*, chelicera; *f*, femur I.

granules of the dorsal surface small and shiny; anterior margin of carapace with 2-3 small indistinct granules on each side of the ocular tubercle; ocular tubercle as in fig. 3, *a*. Seen from the side, its dorsal surface and the area posterior to it with a few scattered granules; areas I-V well defined, at least in the middle, by distinct grooves; areas I-IV with an anterior row of large and a posterior row of small granules; area V and all free tergites with a single row of granules.

Ventral Surface.—Coxae smooth and shiny, IV with its distal fifth shagreened, I with 2 large conical tubercles along its anterior distal margin, the proximal one the larger; stigmata visible on the

stigma-bearing sternite; sternites with 2 rows of round granules, those of the posterior row very small and hardly distinguishable.

Pedipalp.—Femur laterally compressed, especially proximally, the ventral surface blade-like; trochanter and femur as in fig. 3, *b*, seen from the inner side; trochanter above with 2 teeth, the larger one exceeding the 3 dorsal teeth of the femur, below with a compound tooth; femur with 2 teeth distally on its inner surface, which is otherwise very smooth and shiny; patella below with a small tooth on both inner and outer sides; tibia toothed on the outer side as in fig. 3, *c*, on the inner side as in fig. 3, *d*, the ventral surface of the segment between these rows slightly concave and with faint transverse corrugations; tarsus toothed on the outer side as in fig. 3, *c*, on the inner side as in fig. 3, *d*.

Chelicera as in fig. 3, *e*, seen from the inner side, segment II on its posterior surface with a distinct tubercle at the base of the claws.

Legs.—Femur I armed below as in fig. 3, *f*; tarsal segments I, 2; II, 3; III, 3; IV, 3.

Dimensions.—Length of body 4.2, greatest breadth 3.4, pedipalp 6.5 mm. A smaller specimen, which I take to be a ♀, only differs from the above description in the much shorter pedipalps. It has a body length of 3.8, pedipalp of 3.6 mm.

Ceratomontia namaqua n. sp.

(Text-fig. 4.)

Type, 1 specimen (♀?), Leliefontein, Namaqualand.

Colour.—Uniform light yellow.

Dorsal Surface.—Anterior margin of carapace with 2 moderate conical granules on each side of the ocular tubercle; ocular tubercle as in fig. 4, *a*, seen from the side, fig. 4, *b*, seen from above, with a few granules on its dorsal surface; area posterior to the ocular tubercle with a strip of 5–6 granules on each side divided by a narrow smooth strip; areas I–IV with 2 rows of granules, the anterior one composed of much larger granules than the posterior one; area V and free tergites I and II with a single row of larger granules, free tergite III with 2 rows of granules.

Ventral Surface.—Surfaces of coxae smooth, IV shagreened in its distal half, I with some granules and 2 large tubercles along its anterior distal margin, the distal one bifid; genital operculum smooth, broader than long; sternites with an anterior row of well-spaced granules, a row of smaller granules along its posterior margin, these

very close-set, forming a distinct rim along the margin of the segment; between these two rows a very indistinct row of widely spaced granules intermediate in size to those of the anterior and posterior rows; the granules of the anterior and middle rows tipped with setae, the posterior row without setae.

Pedipalp as in fig. 4, *c*, seen from the inner side. Femur with 4 dorsal teeth, the proximal one situated a little more laterally than the others; inner surface of femur finely shagreened, its distal half with 2 teeth, the one large the other much smaller; patella below with a small tooth on each side distally; tibia and tarsus as in fig. 4, *c*.

Chelicera as in fig. 4, *d*, seen from the inner side; segment I with a small tooth at its inner distal edge; segment II with a few low round granules along the inner side of its anterior surface.

Legs.—Femur I ventrally armed as in fig. 4, *e*, patella with 1, tibia with 3 seta-tipped granules ventrally; tarsal segments I, 2; II, 3; III, 3; IV, 3.

Dimensions.—Length of body 2.2, pedipalp 2.4 mm.

Ceratontia pusilla n. sp.

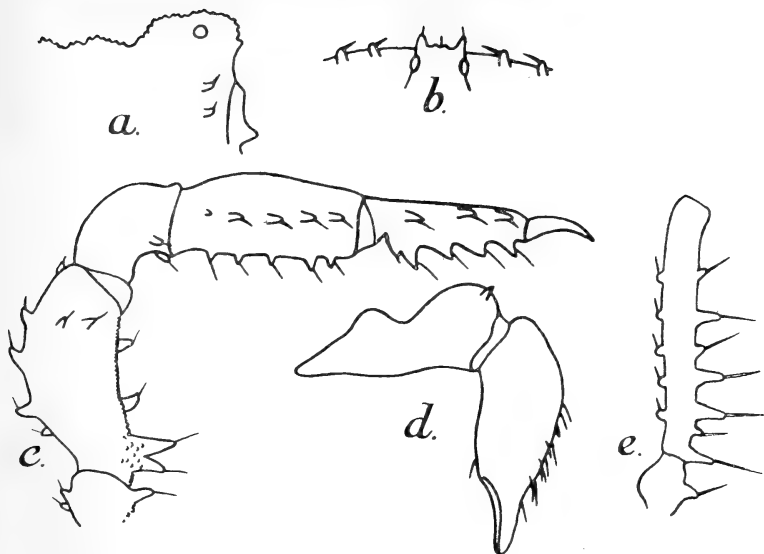
(Text-fig. 5.)

Types, 5 ♂♂, 6 ♀♀, Grahamstown.

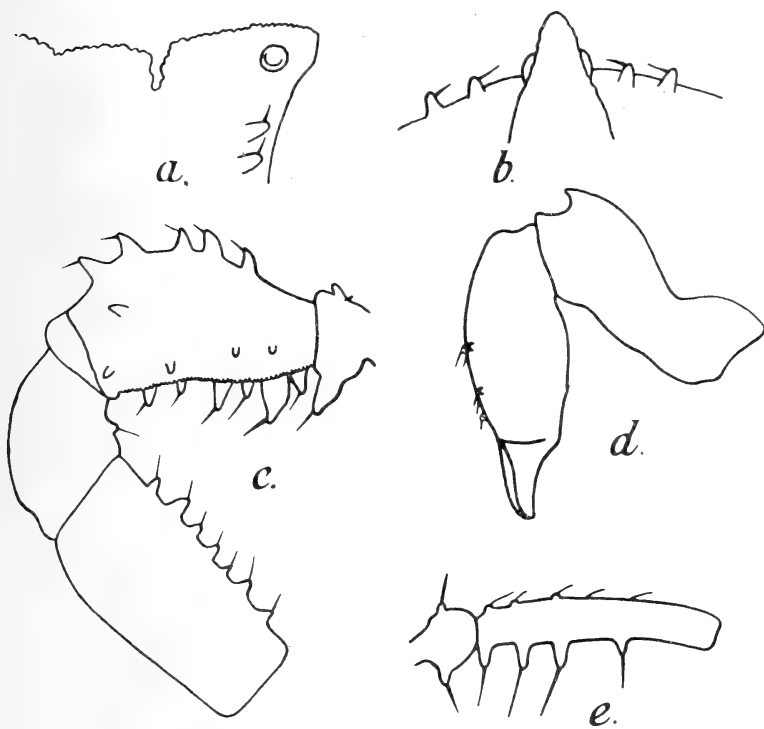
♂. *Colour*.—Body yellow, the posterior segments sometimes infuscated, dorsal scute with or without a median blackish stripe; pedipalps and chelicerae yellow; legs a little darker than the body.

Dorsal Surface.—Anterior margin of carapace with 2 conical granules on each side of the ocular tubercle, the outer one larger than the inner one; ocular tubercle as in fig. 5, *a*, seen from the side, fig. 5, *b*, seen from above, its dorsal surface with some small granules; area posterior to the ocular tubercle with 2 irregular rows of granules; areas I–IV with a row of larger granules near the anterior margin, a row of much smaller granules bordering the posterior margin, the granules of the anterior row with, those of the posterior row without, long white setae at their tips; area V and free tergites I and II with a single well-spaced row of round, seta-tipped granules, free tergite III with more than one such row of granules.

Ventral Surface.—Surfaces of coxae smooth and shiny except the distal $\frac{2}{3}$ of IV which is shagreened, covered with scattered long white setae, coxa I with 2 stout tubercles on its anterior distal margin, some smaller granules behind these; anterior halves of sternites with



TEXT-FIG. 4.—*Ceratomontia namaqua*. *a*, ocular tubercle from the side; *b*, ocular tubercle from above; *c*, pedipalp; *d*, chelicera; *e*, femur I.



TEXT-FIG. 5.—*Ceratomontia pusilla*. ♂: *a*, ocular tubercle from the side; *b*, ocular tubercle from above; *c*, pedipalp femur (tarsus omitted); *d*, chelicera; *e*, femur I.

2 rows of granules tipped with setae, those of the posterior row minute.

Pedipalp.—Femur seen from inner side as in fig. 5, *c*, with a strong tooth on its inner distal surface, the median strip of fine granulation on the ventral surface composed of comparatively few large granules; patella below with 1 tooth at its inner apex; tibia below with 4 inner, 7 outer smaller teeth (fig. 5, *c*); tarsus with 3 triangular teeth on each side, the outer basal one more or less compound and larger than the others.

Chelicera as in fig. 5, *d*, seen from the inner side; segment I armed at its inner distal edge with a minute tooth, segment II with 3–4 granules along its inner anterior surface, a granule on its posterior distal surface, near the base of the immovable finger.

Legs.—Femur I armed below as in fig. 5, *e*, legs otherwise unarmed; tarsal segments I, 2; II, 3; III, 3; IV, 3.

Dimensions.—Length of body 1.5, pedipalp 1.7 mm.

♀. Differing from the ♂ in the smaller pedipalp on the femur of which there are 4 instead of 5 dorsal teeth; teeth on tibia and tarsus proportionately larger than in the ♂; chelicerae smaller, segment II without a toothlike granule at the base of the claws.

Dimensions.—Length of body 1.4, pedipalp 1.3 mm.

Ceratontia nasuta n. sp.

(Text-fig. 6.)

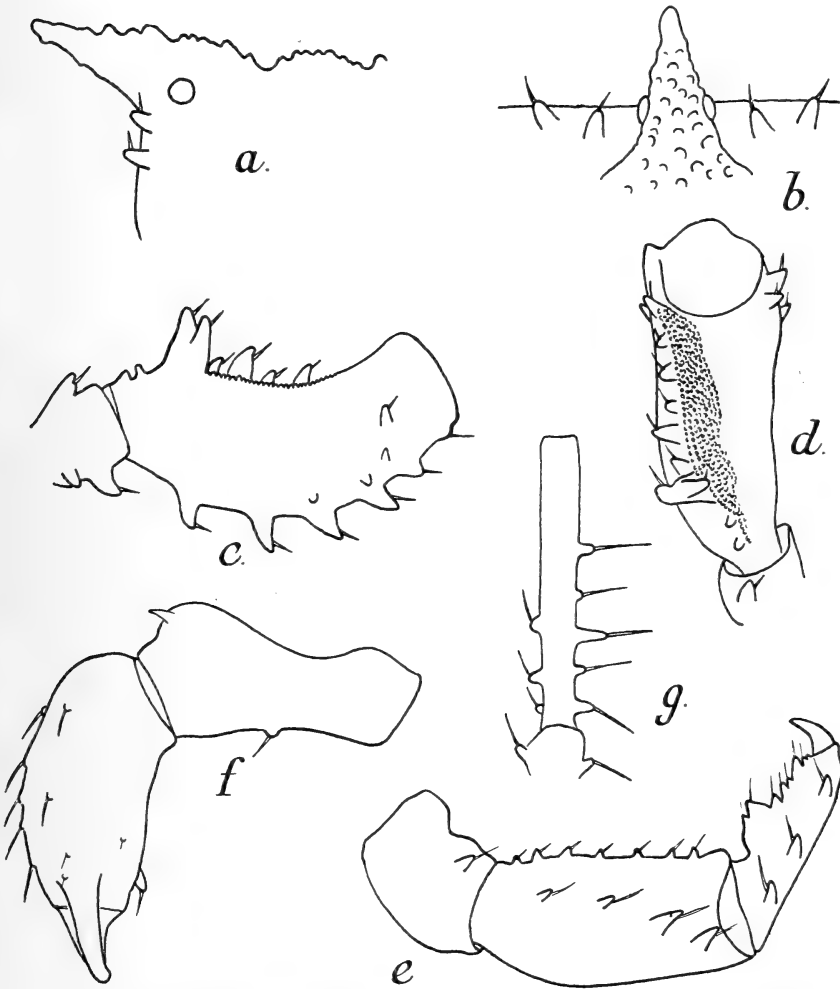
Types, 2 ♂♂, French Hoek, Cape Province.

Colour.—Carapace and area behind the ocular tubercle yellow with blackish markings, remainder of dorsum blackish-brown; inferior surfaces of coxae yellow, remainder of ventral surface brown; appendages blackish-brown.

Dorsal Surface.—Anterior margin of carapace with 2 conical granules on each side of the ocular tubercle; ocular tubercle as in fig. 6, *a*, seen from the side, fig. 6, *b*, seen from above, covered dorsally with coarse granules; area posterior to the ocular tubercle with coarse granules, a narrow longitudinal strip in the middle free of granules; areas I–IV with 2 transverse rows of granules, those of the posterior row considerably smaller than the granules of the anterior row; area V and free tergites I and II with 2 rows of larger granules, free tergite III with 2 irregular rows of larger granules.

Ventral Surface.—Coxae smooth, I with a row of granules and 2

large tubercles on its anterior distal margin; genital operculum smooth, about as long as broad; sternites with 2 rows of granules



TEXT-FIG. 6.—*Ceratomontia nasuta*. ♂: *a*, ocular tubercle from the side; *b*, ocular tubercle from above; *c*, pedipalp femur from inner side; *d*, pedipalp femur from below; *e*, patella, tibia, tarsus of pedipalp; *f*, chelicera; *g*, femur I.

in their anterior half, the anterior row consisting of granules larger than the posterior row, but much smaller than the largest granules of the dorsal surface.

Pedipalp.—Femur as in fig. 6, *c*, seen from the inner side, its inner surface with 4 teeth in the distal half; seen from below (fig. 6, *d*), base of femur with a large bifid tooth on the outer side followed distally by 6 stout simple teeth; mesially to this row a strip of fine granulation which is not flanked on the inner side by a row of rounded granules; patella below with a tooth at its inner apex; tibia below (fig. 6, *e*), with 7–8 small triangular teeth on its outer side and 2–3 larger teeth on its inner side; tarsus below on its outer side as in fig. 6, *e*, seen in profile, its inner side with 3 sharp teeth.

Chelicera, as in fig. 6, *f*, seen from the inner side. Segment I at its inner distal edge with a stout tooth, segment II with a row of round granules along its inner anterior surface.

Legs.—Femur I armed ventrally as in fig. 6, *g*; tarsal segments I, 2; II, 3; III, 3; IV, 3; the distal segment of tarsus I oval in shape, broader than, and twice as long as, the proximal segment.

Dimensions.—Length of body 2·8, pedipalp 3·7 mm.

Ceratomontia annae n. sp.

(Text-fig. 7.)

Type, 1 ♂, Jonkershoek, Stellenbosch.

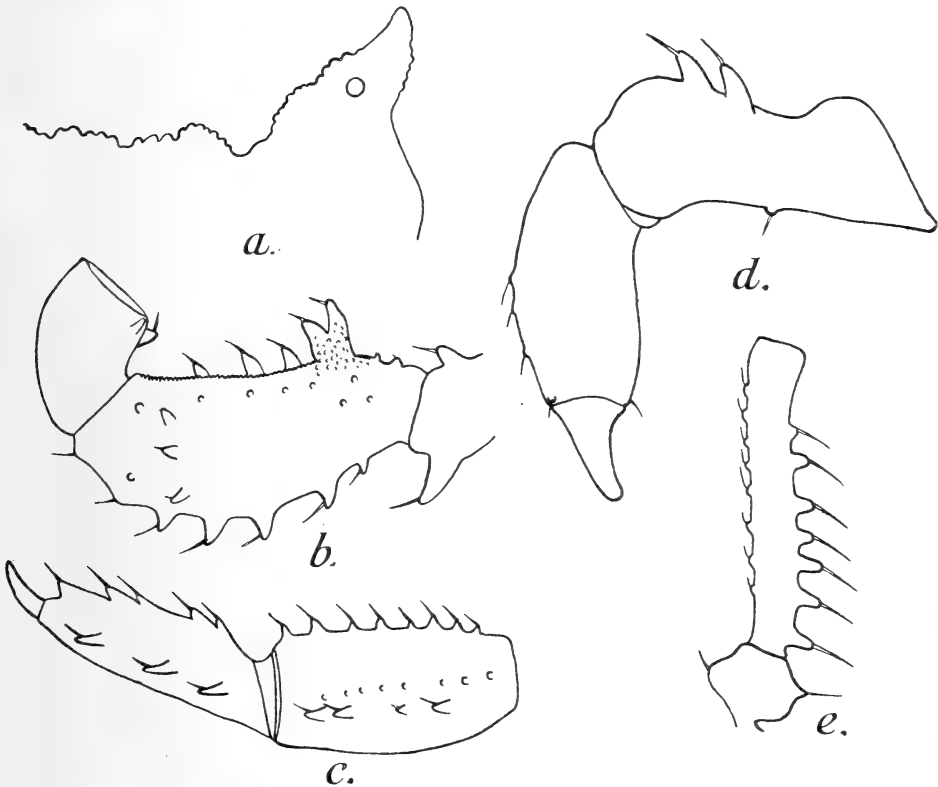
Colour.—Body yellow, variegated with olive-green; appendages yellow with fine olive-green reticulate markings.

Dorsal Surface.—Anterior margin of carapace with 3 inconspicuous granules on each side of the ocular tubercle, these very little larger than the largest granules of the dorsal surface; ocular tubercle as in fig. 7, *a*, seen from the side, its dorsal and lateral surfaces fairly thickly covered with round granules; sides of the carapace smooth; area posterior to the ocular tubercle with 2 longitudinal granular strips, the area between them smooth; areas I–IV with an anterior row of large round granules, a row of smaller granules bordering the posterior margin of the segment; the anterior row not reaching the sides of the segment, composed of conspicuous granules tipped with setae, the posterior row without setae; area IV with the anterior row of granules duplicated laterally, the posterior row composed of very small inconspicuous granules; area V and free tergites I and II with a single row of larger granules, free tergite III with more than one row of these granules.

Ventral Surface.—Coxae smooth, IV shagreened in its distal fourth, coxa I with 2 very low inconspicuous tubercles on its anterior distal margin, the distal one incompletely bifid; sternites with 2

rows of very small inconspicuous granules, much smaller than those of the dorsal surface.

Pedipalp.—Trochanter and femur as in fig. 7, *b*, seen from the inner side; trochanter above with 1 large tooth, larger than the dorsal teeth of the femur; femur below on the outer side with a large basal



TEXT-FIG. 7.—*Ceratomontia annae*. ♂: *a*, ocular tubercle; *b*, femur and patella of pedipalp; *c*, tibia and tarsus of pedipalp; *d*, chelicera; *e*, femur I.

bifid tooth followed by 3 small simple teeth; patella below with a small distal tooth on each side; tibia armed below as in fig. 7, *c*; tarsus with outer side seen in profile as in fig. 7, *c*, inner side with 3 large triangular teeth.

Chelicera as in fig. 7, *d*, seen from the outer side; segment I above with 2 large conspicuous teeth, the anterior one situated a little more mesially than the posterior one; segment II with some round granules along the inner side of its anterior surface.

Legs.—Femur I armed ventrally as in fig. 7, *e*, remaining legs unarmed.

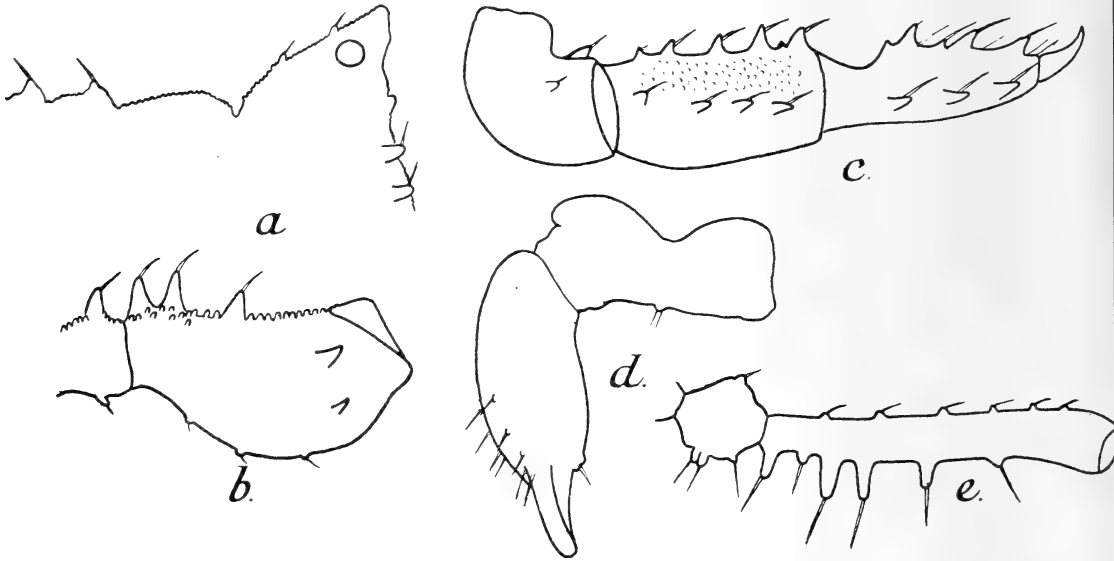
Dimensions.—Length of body 2·7, pedipalp 3·7 mm.

Ceratontia ruricola n. sp.

(Text-fig. 8.)

Type, 1 ♀, Jonkershoek, Stellenbosch.

Colour.—Carapace anterior to areas I–IV yellow, with blackish



TEXT-FIG. 8.—*Ceratontia ruricola*. ♀: *a*, ocular tubercle; *b*, pedipalp femur; *c*, patella, tibia, tarsus of pedipalp; *d*, chelicera; *e*, femur I.

reticulate markings, remainder of dorsum brown; legs brown; pedipalps and chelicerae yellow.

Dorsal Surface.—Dorsum with a background shagreen of minute granules, these rather larger and more clearly defined than usual. Anterior margin of carapace with 2 enlarged granules; ocular tubercle as in fig. 8, *a*, a few scattered granules dorsally and at the sides, a granule similar to those of the anterior margin on each side of the ocular tubercle at its base; area posterior to ocular tubercle without granules; areas I–IV with 1 abbreviated row of conspicuous granules, I with 2, II with 4, III with 6, IV with 8 granules; area V and free tergites I and II with a complete or almost complete transverse row of granules, free tergite III with 2 rows of granules.

Ventral Surface.—Surfaces of coxae smooth, IV with its distal $\frac{1}{2}$ – $\frac{2}{3}$ shagreened, I with 2 tubercles on its anterior distal margin, the distal one bifid; genital operculum broader than long, its surface weakly granular; anterior halves of sternites with 2 transverse rows of granules, the anterior row composed of larger granules.

Pedipalp as in fig. 8, *b*, seen from the inner side; dorsal surface of femur differing from most other *Ceratontia* species in being without teeth, these reduced to minute round granules; the median strip of fine granulation on the ventral surface of femur rather coarse and consisting of quite large granules; patella, tibia, and tarsus below as in fig. 8, *c*, seen from the inner side.

Chelicera as in fig. 8, *d*; segment I unarmed, a small round granule at its inner distal edge.

Legs.—Femur I armed ventrally as in fig. 8, *e*, remaining legs unarmed; tarsal segments I, 2; II, 3; III, 3; IV, 3.

Dimensions.—Length of body 1.9, pedipalp 1.9 mm.

Ceratontia thorni n. sp.

(Text-fig. 9.)

1 specimen (♂?), Meirings Poort, Oudtshoorn.

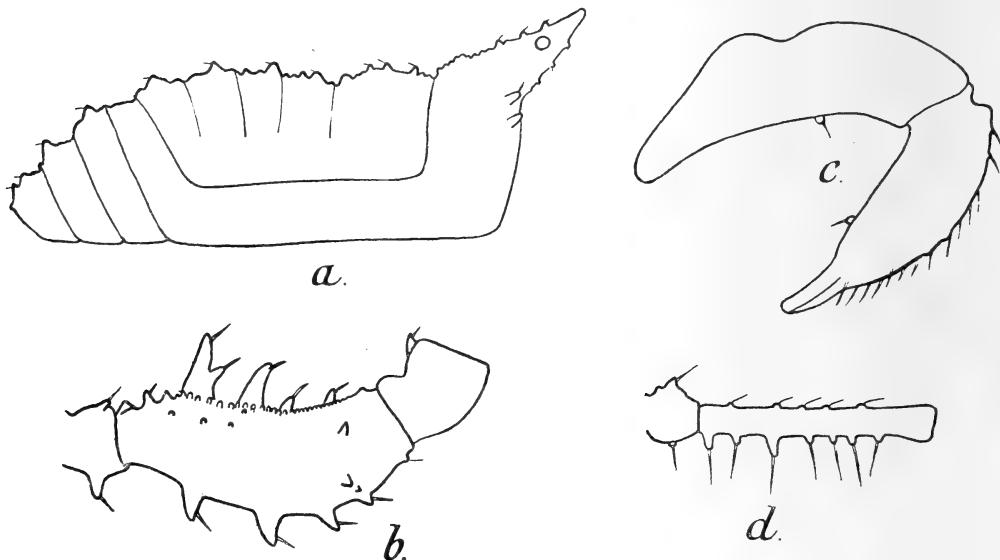
Colour.—Carapace yellow brown variegated with black, remainder of dorsal scute brown with a median black stripe; pedipalps and chelicerae yellow, variegated with black; legs brown.

Dorsal Surface.—Anterior margin of carapace with 2 conical granules on each side of the ocular tubercle, the lateral one the larger. The background of the dorsal surface shagreened with fine granulation, the transverse rows of granules consisting of large, coarse, and sometimes conical granules. Anterior margin of carapace with 2 conical granules on each side of the ocular tubercle, the lateral one the larger; ocular tubercle as in fig. 9, *a*, seen from the side, some large round granules on its dorsal surface; area posterior to the ocular tubercle with 2 longitudinal rows of granules, a strip between them smooth; areas I–IV with 2 rows of granules, the anterior row consisting of large conical granules with long setae at their tips, the posterior row of much smaller granules without setae; area V and free tergites I and II with a single row of large conical granules, III with 2 indistinct rows of granules.

Ventral Surface.—Surfaces of coxae smooth and shiny, IV with its distal two-fifths shagreened, I with 2 tubercles on its anterior distal margin, the distal one bifid; genital operculum as broad as

long; sternites with 2 rows of granules much smaller than those of the dorsal surface.

Pedipalp.—Trochanter, femur, and patella as in fig. 9, *b*, seen from the inner side; femur shagreened on its inner surface; patella below with a small tooth at its outer apex; tibia below with 5 small teeth on its outer side, its inner side with a row of 8–9 small teeth varying considerably in size, laterally to this row 2 much larger teeth near



TEXT-FIG. 9.—*Ceratomontia thorni*. *a*, profile of body; *b*, femur and patella of pedipalp; *c*, chelicera; *d*, femur I.

the distal apex; tarsus on its outer side with a large basal bifid tooth followed by a number of smaller teeth, inner side with 3 sharp teeth.

Chelicera as in fig. 9, *c*, seen from the inner side, segment I without large or small teeth.

Legs.—Femur I as in fig. 9, *d*; tarsal segments I, 2; II, 3; III, 3; IV, 3; tarsus I with the proximal segment one-half the length of the distal segment.

Dimensions.—Length of body 2, pedipalp 2.7 mm.

Named in honour of Mr. C. W. Thorne of the Botanical Staff of the South African Museum.

Key to species of *Ceratomontia*.

1. Femur of pedipalp with a longitudinal row of 10–11 teeth above . . . *wernerii*.
- Femur of pedipalp with a longitudinal row of at most 5 teeth above . . . 2.

2. Areas of dorsal scute with 1 transverse row of granules 3.
Areas of dorsal scute with 2 transverse rows of granules 4.
3. Femur of pedipalp with 4 teeth above *tabulae*.
Femur of pedipalp without teeth above *uricola*.
4. Segment I of chelicera without large teeth above, its distal upper edge some-
times with a blunt tooth 5.
Segment I of chelicera with 1 or 2 large teeth above 11.
5. Ventral surface of pedipalp femur without a longitudinal strip of fine granu-
lation 6.
Ventral surface of pedipalp femur with a longitudinal strip of fine granu-
lation 7.
6. Femur of pedipalp above with 4 small teeth *capensis*.
Femur of pedipalp above with 2 teeth in basal half *reticulata*.
7. Length of body more than 4 mm., colour red *sanguinea*.
Length of body 1.5-3 mm., colour not red 8.
8. Anterior margin of carapace with 4 granules on each side of the ocular
tubercle *irregularis*.
Anterior margin of carapace with 2 granules on each side of the ocular
tubercle 9.
9. Ventral surface of pedipalp femur without a bifid tooth at its base *pusilla*.
Ventral surface of pedipalp femur with a bifid tooth at its base 10.
10. Ocular tubercle apically truncate and short *namaqua*.
Ocular tubercle apically slender and long *thorni*.
11. Segment I of chelicera with 2 large subequal teeth above 12.
Segment I of chelicera with 1 large tooth above 13.
12. Femur of pedipalp with the dorsal teeth almost equal-sized, ocular tubercle
pointed *annae*.
Femur of pedipalp with the dorsal teeth varying in length, ocular tubercle
short and truncate *minor*.
13. Ocular tubercle drawn out into a spine 5-6 times the diameter of the
eye 14.
Ocular tubercle not drawn out into a spine, terminal process short or absent
16.
14. Anterior margin of carapace with 2 conical granules on each side of the ocular
tubercle *nasuta*.
Anterior margin of carapace with 3 conical granules on each side of the ocular
tubercle 15.
15. Segment II of chelicera with a thickened tubercle above the immovable claw
cheliplus.
Segment II of chelicera without a thickened tubercle above the immovable
claw *fluvialis*.
16. Anterior margin of carapace with 3 conical granules on each side of the ocular
tubercle *hewitti*.
Anterior margin of carapace with 2 conical granules on each side of the ocular
tubercle 17.
17. Segment I of chelicera above with an upright tooth in the middle *karrooensis*.
Segment I of chelicera above with a hooked tooth near the distal apex
setosa.

Genus LAWRENCILLA E. Strand.

1932. *Lawrencilla*, E. Strand, Folia. Zool. et Hydrob., Latvia University, Riga, vol. iv, p. 142.

1931. *Roeweria*, Lawrence (Non Mello-Leitao, 1923), Ann. S.A. Mus., vol. xxix, p. 384 (nom. preocc.).

The name *Lawrencilla* was proposed by Strand to take the place of the name *Roeweria* which had already been employed by Dr. Mello-Leitao in 1923 (Arch. Mus. Nacion., Rio de Janeiro, vol. xxiv, p. 166). The name *Roeweria* (Lawrence) therefore, which was erected in honour of Professor C. Fr. Roewer, must be discarded.

Lawrencilla inermis (Lawrence).

This rare species was based on a single specimen from Newlands. Since its description another (juvenile) specimen has been found at Camps Bay, Cape Peninsula.

PARAMONTIA n. genus.

Genotype, *Rostromontia lisposoma*, Lawrence, Ann. S.A. Mus., vol. xxix, p. 392, 1931, fig. 26, *a-f*.

Whole of dorsal surface smooth, without rows of granules, the areas well defined by transverse grooves; ocular tubercle short and not drawn out into a spine; inferior surfaces of coxae I and II granular, coxa I without 2 large tubercles on its anterior distal margin; stigmata hidden; femur of pedipalp without a median strip of fine granulation on its ventral surface; femur of leg III armed with larger granules than those of femur I; calcaneus of all legs much shorter than astragalus; median prong of claws of tarsi III and IV much stouter than the lateral prongs; tarsal segments short and stout, especially those of leg III; number of tarsal segments I, 3; II, 5; III, 4; IV, 4. This genus agrees with *Rostromontia* in the number of tarsal segments, but differs from it in the complete absence of dorsal granulation, the absence of coxal tubercles, and in having the ventral armature of leg III more pronounced than that of leg I.

Paramontia infinita n. sp.

(Text-fig. 10.)

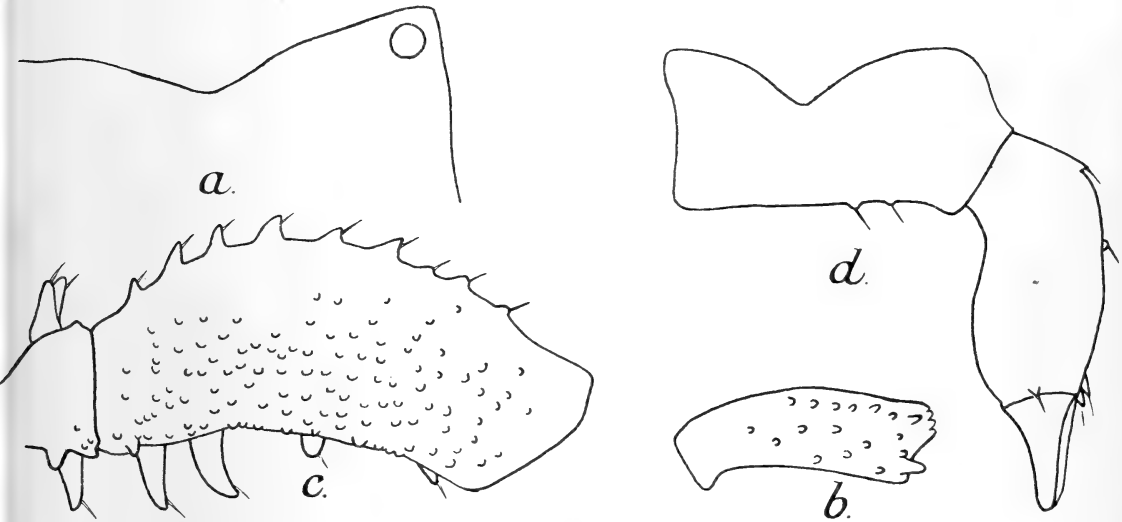
Types, 1 ♂, 4 ♀♀, River Zonder End.

♂. Colour blackish-brown, except carapace, which is yellow brown

with blackish reticulation; pedipalps and chelicerae with blackish reticulate markings; legs uniform, blackish-brown.

Dorsal surface smooth and slightly creased, without rows of granules, the areas divided by well-defined transverse grooves; ocular tubercle as in fig. 10, *a*, seen from the side.

Ventral Surface.—Surfaces of coxae shagreened, coxa I, II, and to a less extent III with scattered granules in their distal halves, coxa I, fig. 10, *b*, with an enlarged granule at its anterior distal apex but no tubercles as in *Rostromontia*; coxae III and IV with a row



TEXT-FIG. 10.—*Paramontia infinita*. ♂: *a*, ocular tubercle; *b*, coxa I; *c*, pedipalp femur; *d*, chelicera.

of granules along their posterior margins; genital operculum longer than broad, shagreened, and with a few small seta-tipped granules; sternites matt, without granules.

Pedipalp.—Trochanter and femur as in fig. 10, *c*, seen from the inner side. Femur below with 2 large basal equal-sized teeth on its outer side followed by 2 moderate teeth, the latter not clearly seen in fig. 10, *c*; ventral surface without the usual strip of fine granulation, inner surface almost entirely covered with coarse, round, smooth granules, outer surface quite smooth and shiny; patella below with 2–3 small round granules on its inner side; tibia below with an irregular row of unequal granules on its inner side, a row

of smaller granules on its outer side, a third row of granules between and parallel to these rows; tarsus armed as in *lisposoma*.

Chelicera as in fig. 10, *d*, seen from the outer side.

Legs.—Femur III ventrally with larger granules than those of femur I; tarsal segments of leg III stout, but a little longer than broad; tarsal segments I, 3; II, 5; III, 4; IV, 4.

Dimensions.—Length of body 4, pedipalp 4.8 mm.

♀. Differing from the ♂ in having considerably shorter pedipalps; ventral surface of pedipalp femur with smaller teeth than those of the ♂, these equal sized; inner surface of femur differing from that of the ♂ in being covered with fine matt granulation in its proximal half, the coarse round granules being only present on the distal half; tibia and tarsus with larger teeth than in the ♂; legs armed as in ♂. Genital operculum about as long as broad, the extruded ovipositor with an apical ring of 16–18 long and stout setae.

Dimensions.—Length of body 3.6, pedipalp 3.1 mm.

Key to species of Paramontia.

1. Ventral surface of pedipalp femur with 2 large equal-sized teeth near its base
infinita.
- Ventral surface of pedipalp femur with the 2 basal teeth not equal-sized
lisposoma.

Genus AUSTROMONTIA Lawrence.

(Text-fig. 11.)

Austromontia bidentata n. sp.

Type, 1 specimen (♂?), Jonkershoek, Stellenbosch.

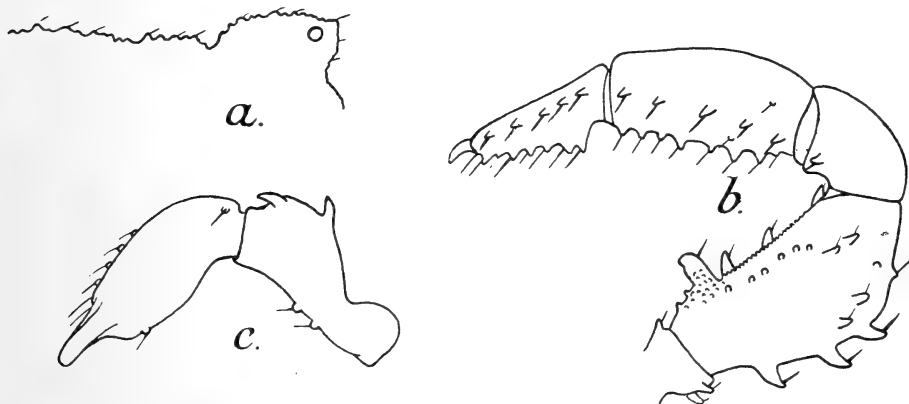
Colour.—Uniform brown.

Dorsal Surface.—Anterior margin of carapace with 2 granules on each side of the ocular tubercle, these hardly larger than the remaining granules of the dorsal scute; ocular tubercle as in fig. 11, *a*, seen from the side, covered dorsally with granules; area posterior to the ocular tubercle with 1–2 short longitudinal rows of granules on each side of a smooth median strip; areas I–IV with 2 rows of inconspicuous granules, those of the anterior row very little larger than the granules of the posterior row; area V and free tergites I and II with a single transverse row of granules.

Ventral Surface.—Surfaces of coxae creased but shiny, the distal third of IV shagreened, I with 2 simple tubercles at its anterior

distal margin; sternites with 2 rows of granules, those of the anterior row the larger.

Pedipalp as in fig. 11, *b*, seen from the inner side. Trochanter with 2 widely separated teeth above, 1 smaller tooth below; ventral surface of femur with a large basal tooth on the outer side followed by 2 distal teeth and an apical tooth not seen in fig. 11, *b*; patella below with 1 tooth near the inner distal apex; tibia as in fig. 11, *b*; mesially to the 5 teeth on the inner side some round granules, the whole of the ventral surface between the inner and outer rows of granules shagreened; tarsus as in fig. 11, *b*.



TEXT-FIG. 11.—*Austromontia bidentata*. *a*, ocular tubercle; *b*, pedipalp; *c*, chelicera.

Chelicera as in fig. 11, *c*, seen from the inner side; segment I with an anterior tooth at the inner distal edge, a second posterior tooth situated a little more laterally than the anterior one; segment II with a row of low round granules on the inner side of the anterior surface.

Legs.—Femur I with 4 granules on its ventral surface, legs otherwise unarmed.

Dimensions.—Length of body 1.9, pedipalps 2.7 mm.

Austromontia litoralis n. sp.

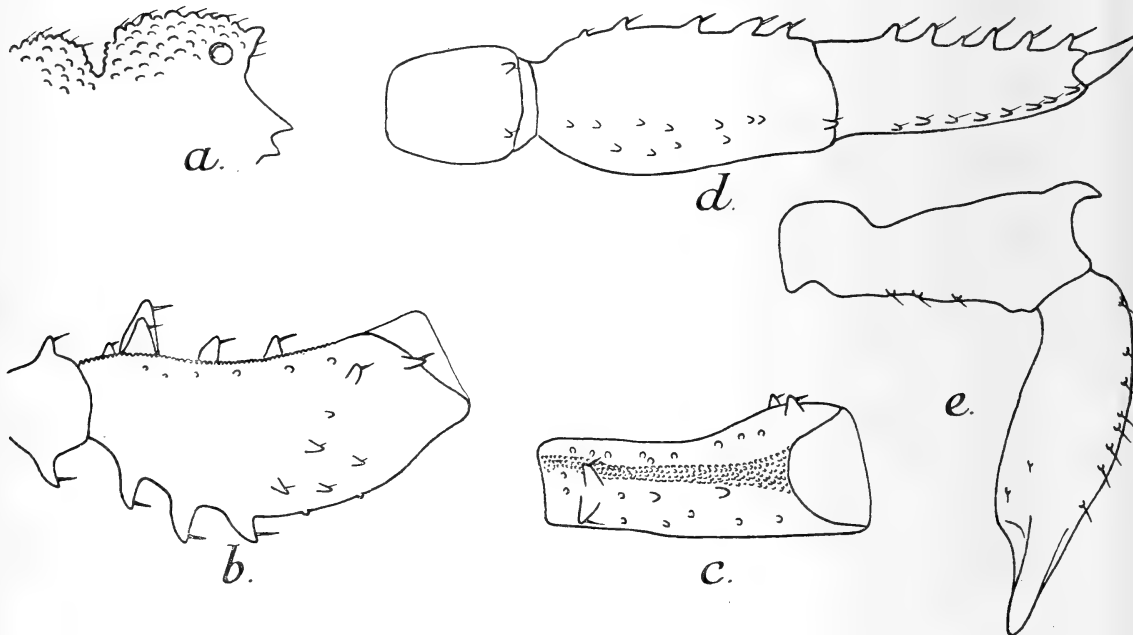
(Text-fig. 12.)

Type, 1 ♂, Hermanus.

Colour.—Uniform yellow.

Dorsal Surface.—Anterior margin of carapace with 1–2 granules on each side of the ocular tubercle; ocular tubercle as in fig. 12, *a*,

seen from the side, its dorsal surface fairly thickly studded with small round granules; carapace at the sides of the ocular tubercle without granules; area posterior to the ocular tubercle with several rows of granules, a short longitudinal strip in the middle without granules; areas I-IV with 2 transverse rows of granules, the anterior one rather irregular and composed of granules slightly larger than those of the posterior row, which is very regular and borders the posterior margin of the segment; area V and free



TEXT-FIG. 12.—*Austromontia litoralis*. ♂: a, ocular tubercle; b, pedipalp femur from the side; c, pedipalp femur from below; d, patella, tibia, tarsus of pedipalp; e, chelicera.

tergites I and II with a single transverse row of granules in the middle, free tergite III with 2 rows of granules.

Ventral Surface.—Surfaces of coxae without granules, shiny and rather creased, coxa I at its anterior distal margin with 2 large conical tubercles, the apical one bifid; genital operculum longer than wide, triangular, and with a slightly thickened rim; sternites with 2 rows of widely spaced, round, seta-tipped granules in their anterior half.

Pedipalp.—Femur and trochanter as in fig. 12, b, seen from the inner side; femur with 4-5 teeth on its inner distal surface; seen

from below (fig. 12, *c*), its ventral surface with a row of 8 small round shiny granules on the inner side, a middle row of 3 large teeth, the basal one bifid, and an outer row of 5 granules; between the inner and middle rows of teeth the usual strip of fine granulation; patella, tibia, and tarsus as in fig. 12, *d*, seen from below.

Chelicera as in fig. 12, *e*, seen from the inner side; segment I with a single hooked tooth on the inner side of its upper distal edge; segment II with a row of small round granules along the inner side of its anterior surface.

Legs.—Femur I without enlarged conical granules on its ventral surface except for a few near its base; tarsal segments I, 3; II, 4; III, 4; IV, 4; calcaneus of leg I a little more than half, calcaneus of leg II half the length of the astragalus.

Dimensions.—Length of body 3, pedipalp 4.3 mm.

Key to species of Austromontia.

- | | |
|----------------------------------------------------------------------------|---------------------|
| 1. Pedipalp femur below with a simple tooth near its base | 2. |
| Pedipalp femur below with a large compound tooth near its base | 3. |
| 2. Segment I of chelicera with 1 tooth above | <i>silvatica</i> . |
| Segment I of chelicera with 2 teeth above | <i>bidentata</i> . |
| 3. Calcaneus of metatarsi I and II half the length of astragalus | <i>litoralis</i> . |
| Calcaneus of metatarsi I and II much shorter than astragalus | 4. |
| 4. Pedipalp femur below with a bifid tooth near the base | <i>capensis</i> . |
| Pedipalp femur below with a trifid tooth near the base | <i>caledonica</i> . |

Genus BIACUMONTIA Lawrence.

Biacumontia variegata n. sp.

(Text-fig. 13.)

Type, 1 specimen (sex ?), Keurbooms River, near Knysna.

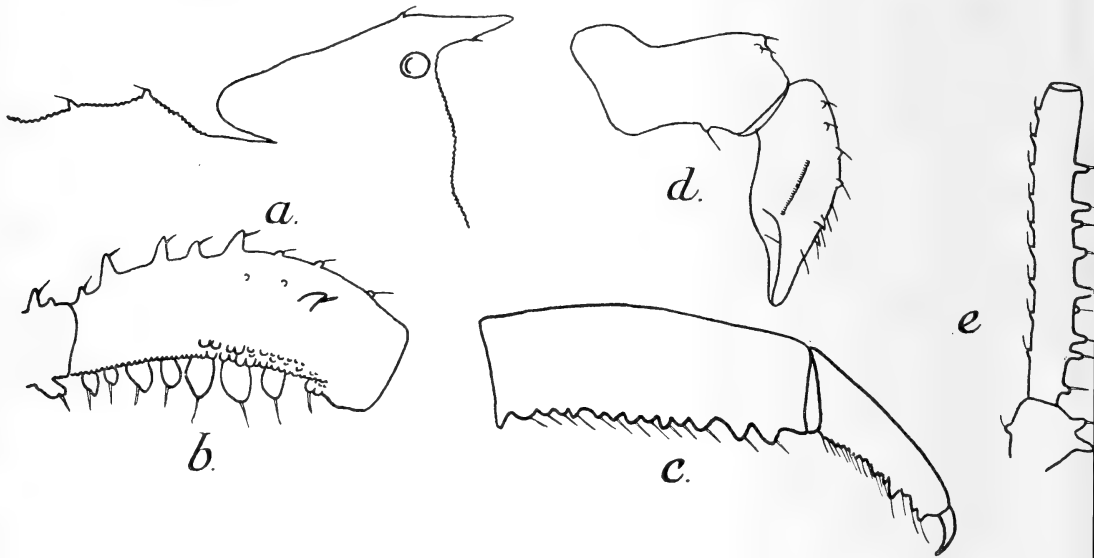
Colour.—Body yellow, anterior half of body, especially the ocular tubercle, with blackish markings, dorsal scute with a median blackish stripe, tergites with blackish markings, appendages variegated with blackish reticulate markings and bands.

Dorsal Surface.—Ocular tubercle as in fig. 13, *a*, seen from the side; areas I–IV each with an abbreviated row of enlarged conical granules in the middle, I with 2, II with 4, III and IV with about 6 granules; area V and free tergites I and II with a complete row of granules reaching from side to side, free tergite III with 2 rows of granules.

Ventral Surface.—Surfaces of coxae smooth and shiny, IV shagreened in its distal half, I with 2 tubercles at its anterior distal

margin, the more distal one bifid; sternites with a very distinct row of close-set round granules.

Pedipalp.—Femur as in fig. 13, *b*, seen from the inner side, with 8 dorsal teeth, the basal one minute, the apical one granuliform; ventral surface of femur with an outer row of rather swollen globose teeth, mesially to this row the usual strip of minute granules, those opposite the fifth and sixth teeth much enlarged; patella below without teeth; tibia below toothed on its outer side as in fig. 13, *c*,



TEXT-FIG. 13.—*Biacumontia variegata*. *a*, ocular tubercle; *b*, pedipalp femur; *c*, tibia and tarsus of pedipalp; *d*, chelicera; *e*, femur I.

its inner side without teeth; tarsus below on its outer side as in fig. 13, *c*, its inner side with 3 teeth.

Chelicera as in fig. 13, *d*, seen from the inner side; segment I with 2 small round granules at its dorsal distal edge; segment II with the usual row of 17 minute teeth on its inner surface, 2 small sharp teeth on its inner anterior surface near the base of the claws.

Legs.—Femur I armed as in fig. 13, *e*, on its ventral surface, femur III with a few ventral granules similar to but smaller than those of I, remaining legs unarmed; tarsal segments I, 2; II, 4; III, 3; IV, 3.

Dimensions.—Length of body 2.5, pedipalp 3.2 mm.

This species resembles *cornuta* in the shape of the ocular tubercle and *truncatidens* in the dentition. It is a very short stout form, with

its dorso-ventral measurement (height), not much less than its antero-posterior measurement (length).

Key to species of Biacumontia.

1. Ocular tubercle with a posterior process 2.
 Ocular tubercle without a posterior process 3.
2. Posterior process of ocular tubercle spinelike, calcaneus of metatarsus II
 more than $\frac{1}{2}$ length of astragalus *cornuta*.
 Posterior process of ocular tubercle rounded, calcaneus of metatarsus II
 $\frac{1}{2}$ length of astragalus *variegata*.
3. Areas of dorsal scute with 2 rows of enlarged granules. *truncatidens*.
 Areas of dorsal scute with a single row of enlarged granules 4.
4. Ventral surface of pedipalp femur with 4 large simple teeth *paucidens*.
 Ventral surface of pedipalp femur with 7 large teeth, some of these bifid
 *fissidens*.

ROEWERANIA n. genus.

Dorsal scute unarmed and without grooves dividing it into areas; ocular tubercle low, without a terminal spine; stigmata clearly visible; pedipalp much elongated, especially in the ♂, where it is more than four times the length of the body; trochanter of pedipalp differing from all other Triaenonychid genera in being extremely elongate (a little shorter than the length of the body in the ♂); all segments of pedipalp armed with strong spines tipped with long setae, these spines often longer than the diameter of the segment on which they are placed; chelicerae elongate; legs long and slender, none of the femora armed ventrally with spines; calcaneus of metatarsi I and II much shorter than astragalus; median prong of claws of tarsi III and IV longer and stouter than the lateral prongs; tarsal segments I, 3; II, 8–10; III, 4; IV, 4.

Roewerania lignicola n. sp.

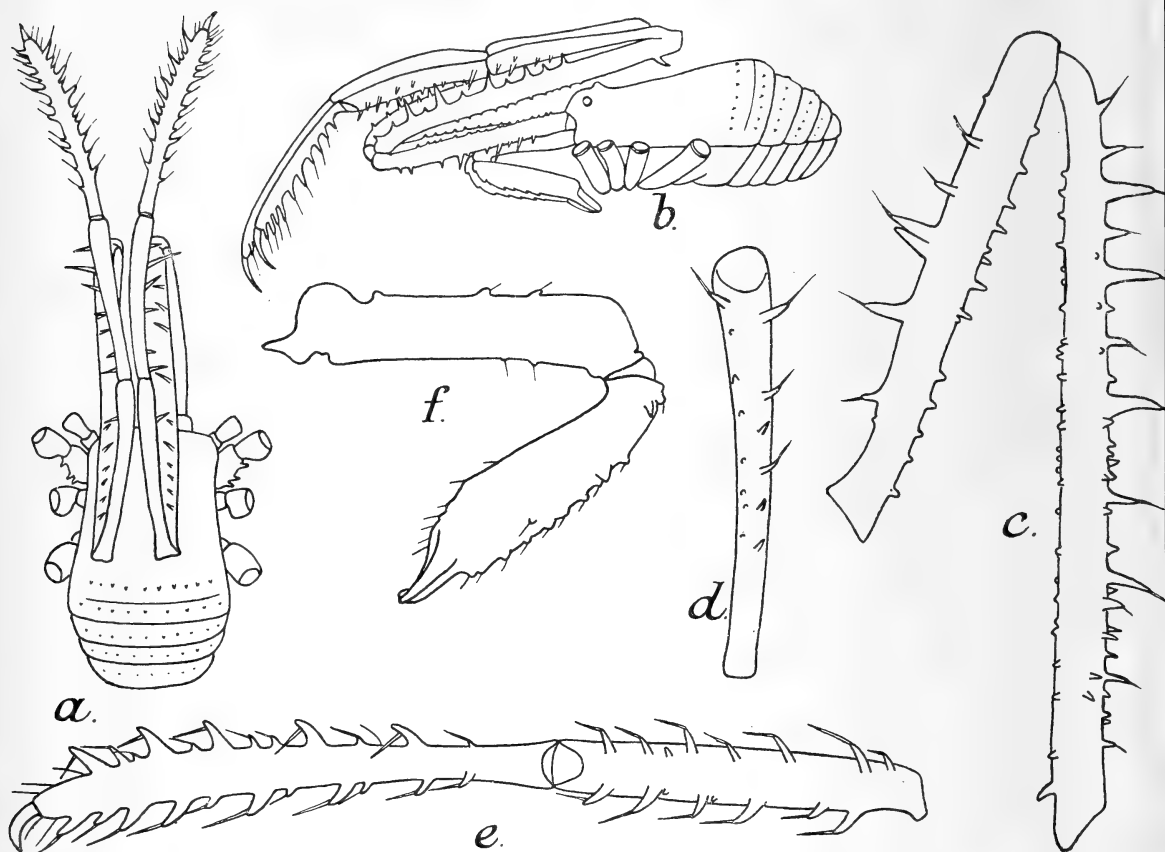
(Text-fig. 14.)

Types, 8 ♂♂, 10 ♀♀, Hogsback, Amatola Mts.

♂. *Colour*.—Body and appendages uniformly yellow.

Dorsal Surface.—Anterior margin of carapace with a small granule about half-way between the ocular tubercle and the antero-lateral angle of the carapace; ocular tubercle as in fig. 14, *b*, seen from the side; dorsal scute practically smooth, area V and free tergites with a transverse row of minute hardly distinguishable seta-tipped granules (fig. 14, *a*).

Ventral Surface.—Surfaces of coxae not shiny but finely shagreened, sparsely covered with minute seta-tipped granules, coxa I with 4 larger granules along its anterior margin, 1 basal, 1 in the middle, the remaining 2 situated close together near the distal apex; genital



TEXT-FIG. 14.—*Roewerania lignicola*. ♂: a, body from above; b, body from the side; c, trochanter and femur of pedipalp; d, patella of pedipalp; e, tibia and tarsus of pedipalp; f, chelicera.

operculum shagreened, about as long as broad; sternites shagreened, with 2 rows of minute granules.

Pedipalp as in fig. 14, b, seen from the side; trochanter and femur spined as in fig. 14, c, seen from the side; patella spined as in fig. 14, d, seen from below; tibia spined as in fig. 14, e, seen from below; tarsus spined as in fig. 14, e, seen from below.

Chelicera not armed with spines as in the pedipalp, the anterior

surface of segment II with a row of distinct granules (fig. 14, *f*). Legs as in generic description. Length of the whole palp more than 4 times the body length (in one specimen $4\frac{1}{2}$ times as long); trochanter of pedipalp in some specimens but little shorter than the body length.

Dimensions.—Length of body 2·3, pedipalp 10 mm.; in a larger specimen the same dimensions are respectively 2·6 and 11·8 mm.

♀. A number of specimens have very much shorter pedipalps (about twice the body length); these I take to be females. Unfortunately in none of the specimens does the penis or ovipositor protrude from beneath the genital operculum; in these female specimens the genital operculum is broader than long, but other than in this character and the length of the pedipalp they do not seem to differ from the males.

Dimensions.—Length of body 2·6, pedipalp 5·5 mm.

This interesting species was found living under damp, rotting logs. The pedipalps in the living specimens were always carried folded back over the dorsal scute between the legs, as shown in fig. 14, *a*, *b*.

SUBFAM. **Adaeinae** Pocock.

Genus **ADAEULUM** Roewer.

Adaeulum brevidentatum n. sp.

(Text-fig. 15.)

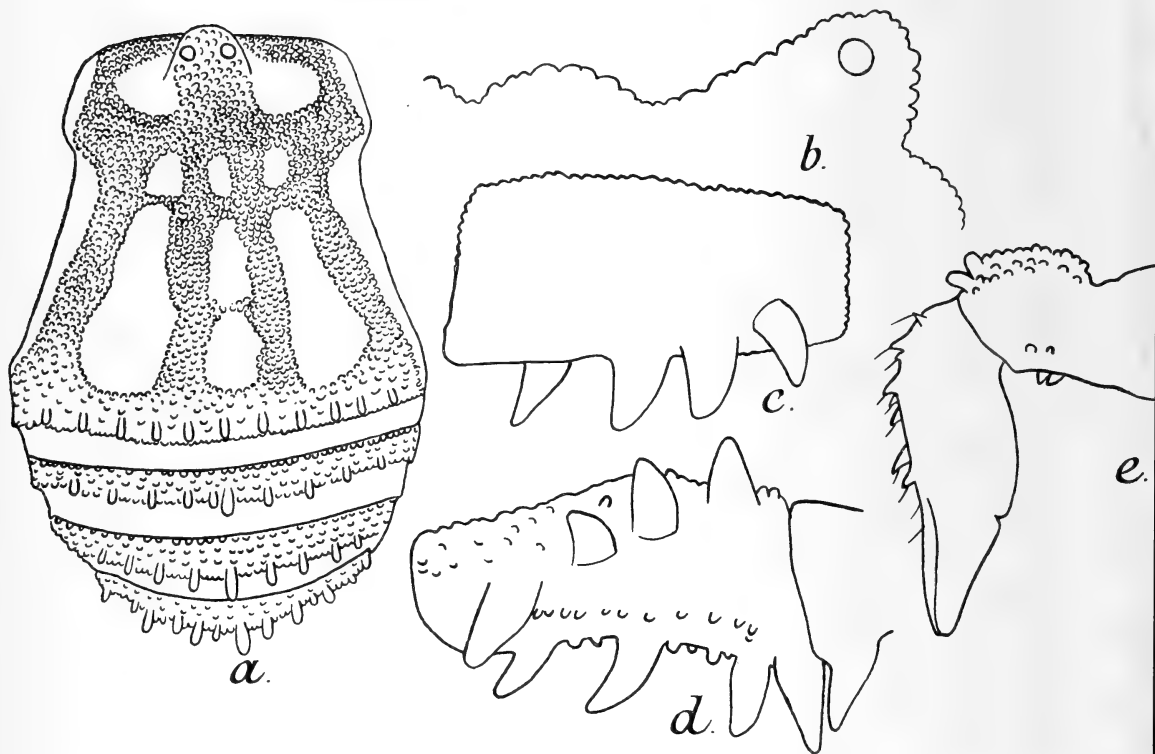
Types, 2 ♂♂, 1 ♀, Hogsback, Amatola Mts. Collected by Dr. S. Manton.

♂. *Colour*.—Body and appendages blackish-brown with a greenish tinge.

Dorsal Surface.—Anterior margin of carapace with a few enlarged granules in the middle; ocular tubercle low and rounded as in fig. 15, *b*, seen from the side; granulation of dorsal surface as in fig. 15, *a*, the smooth areas between the strips of granules shiny; each of the areas with a pair of low granular tumuli, but as these are connected by two longitudinal strips of granules in the middle line, they are hardly distinguishable individually; area V and free tergites with a transverse row of cylindrical, apically swollen granules.

Ventral Surface.—Surfaces of coxae evenly and densely covered with minute granules, anterior margin of coxa I with larger conical granules; genital operculum with some conical granules along its anterior edge; sternites in their anterior half with a strip of minute granules.

Pedipalp.—Trochanter as in fig. 15, *d*, seen from the inner side, with 2 teeth on its ventral surface, the inner one the larger of the two (not seen in this figure); femur seen from above (fig. 15, *c*), with 3 short stout triangular teeth on the proximal three-fifths of its inner surface, a larger tooth near the inner apex of its ventral surface directed downwards and slightly inwards; femur seen from the



TEXT-FIG. 15.—*Adaeulum brevidentatum*. ♂: *a*, body from above; *b*, ocular tubercle from the side; *c*, pedipalp femur from above; *d*, pedipalp femur from inner side; *e*, chelicera.

inner side (fig. 15, *d*), with 4 stout teeth on its outer ventral side, these teeth of more or less uniform size, not long but broad and strong; tibia with some scattered large shiny granules on its ventral surface, patella and tarsus without such granules; none of these segments with teeth or enlarged granules except for the usual 3 triangular teeth on each side of the tarsus.

Chelicera as in fig. 15, *e*, seen from the outer side, segment I without teeth at its dorsal distal apex, instead with 2 enlarged granules;

segment II with some sharp teeth along the inner side of its anterior surface.

Legs with femora wholly unarmed, tarsal segments I, 4; II, 11-12; III, 4; IV, 4.

Dimensions.—Length of body 6, breadth 4, pedipalp 4 mm.

♀. Colour and granulation of the body as in ♂; pedipalp femur with 4 short teeth on its inner surface; its ventral surface with 2 teeth at its inner apex, 3 teeth along the outer side, the 2 largest situated close to each other at the base, the third considerably more distally; patella below with 2 teeth on its inner side; tibia with 2 enlarged granules on its inner side, 1 at the outer apex; tarsus with 3 teeth on each side smaller than those of the ♂. Chelicerae as in the ♂. Femora of legs unarmed, tarsal segments I, 4; II, 11; III, 4; IV, 4.

Dimensions.—Length of body 5·4, breadth 3·5, pedipalp 3·1 mm.

The male of this species differs from those of the other known forms in the short pedipalps, which are armed with unusually short but strong teeth.

Genus LARIFUGELLA Lawrence.

Larifugella longipalpis n. sp.

(Text-fig. 16.)

Type, 1 ♂, Van Staden's River, Port Elizabeth.

Colour.—Body blackish brown tinged with green, pedipalps and chelicerae a little lighter.

Dorsal Surface.—Anterior margin of carapace with 1 enlarged granule in the middle and 1 at each antero-lateral angle of the carapace; ocular tubercle as in fig. 16, *a*, seen from the side, fig. 16, *b*, seen from directly behind, with some large granules posteriorly and at the sides; dorsal scute uniformly covered with numerous minute granules but without transverse rows dividing it into areas; areas I-IV each with a pair of unusually large, pointed, tooth-like, and slightly recurved enlarged granules; area V with a transverse row of about 10 enlarged conical granules, those at the sides smaller, the interspaces of this row filled up with minute round granules, a strip behind this row smooth; free tergite I with a transverse row of about 10 large conical granules, a single row of minute granules anterior to this row, an irregular row of minute granules filling the interspaces of this row; free tergite II similarly with a row of about 15 enlarged conical granules varying somewhat in size, the anterior

row of minute granules duplicated; free tergite III with the row of enlarged conical granules duplicated, an irregular strip of minute granules anterior to it.

Ventral Surface.—Surfaces of coxae sparsely covered with minute



TEXT-FIG. 16.—*Larifugella longipalpis*. ♂: a, profile of body; b, ocular tubercle from behind; c, pedipalp from inner side; d, chelicera.

granules, coxa I in its anterior half with some much larger conical granules, especially distally; sternum long and narrowly triangular; genital operculum with about 6 conical granules along its distal edge; sternites with an anterior row of minute granules, a posterior row of well-spaced, moderate, seta-tipped granules, the last sternite with less regular granulation.

Pedipalp remarkably long, tibia slightly swollen ventrally but not

so markedly as in *L. natalensis*; whole of the dorsal surface of pedipalp covered with minute granules, ventral surface of femur with a few scattered granules, those of the remaining segments quite smooth; femur dorsally with 3 enlarged granules; ventral surface of femur weakly armed, with only 1 basal tooth on the outer side, followed distally by some moderate teeth (fig. 16, c); inner surface of femur with 4-5 enlarged teeth in its proximal two-thirds (these not seen in fig. 16, c), and a large hooked apical tooth with a second smaller tooth proximal to it (seen in fig. 16, c); patella below without teeth; tibia below with 3 strong outer teeth (not seen in fig. 16, c), and 1 apical inner tooth; tarsus below with 3 triangular teeth on each side.

Chelicera as in fig. 16, d, seen from the inner side; segment I granular above, its distal edge with 2 conical teeth, the inner one considerably larger than the outer one; segment II along its inner anterior surface with a row of stout teeth varying in size.

Legs.—Femur I with 2-3 inconspicuous conical granules on its ventral surface; terminal section of tarsus II composed of 3 segments on the one side, of 4 on the other; tarsal segments I, 4; II, 17; III, 4; IV, 4.

Dimensions.—Length of body 8.1, breadth 6.4, pedipalp 11.6 mm.

This species is easily distinguishable from the two other species of the genus, *L. afra* and *natalensis*, by the great length of its pedipalps. It is also the largest Triaenonychid yet found in South Africa.

Genus LARIFUGA Loman.

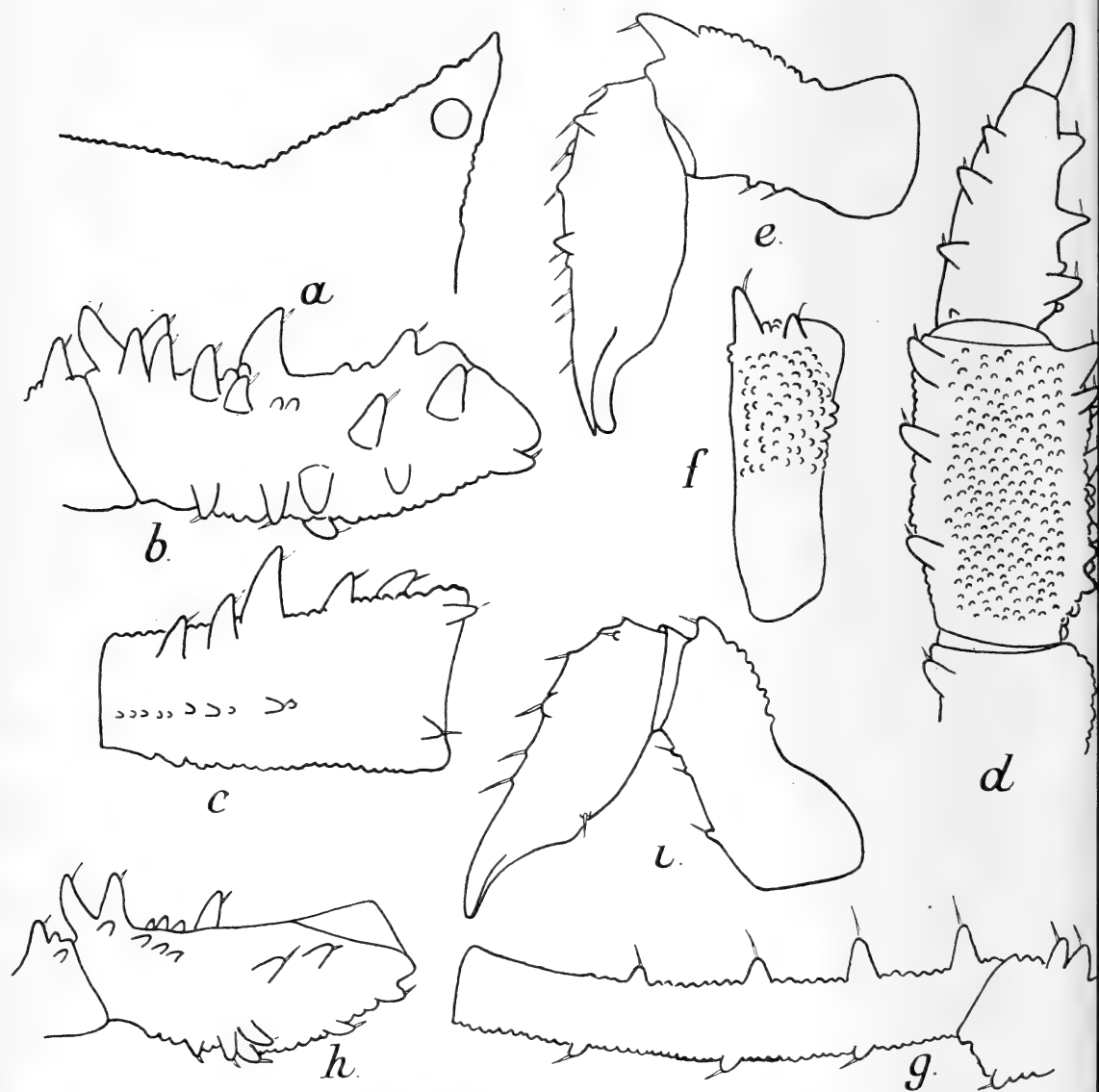
Larifuga mantoni n. sp.

(Text-fig. 17.)

Types, 1 ♂, 1 ♀, Hogsback, Amatola Mts., deposited in the Albany Museum, Grahamstown.

♂. *Colour*.—Body blackish-brown, legs blackish-brown, pedipalps and chelicerae a little lighter.

Dorsal Surface.—Anterior margin of carapace with a row of 9-11 moderate blunt granules on each side of the ocular tubercle, those at the antero-lateral angles of the carapace a little larger and conical; ocular tubercle as in fig. 17, a, seen from the side; carapace just posterior to the ocular tubercle divided into a middle and two lateral areas by rows of minute round granules; dorsal scute divided into 4 smooth areas by regular transverse rows of minute round granules, these rows 2-3 granules deep, broken in the middle anteriorly but more or less continuous in the posterior areas; areas I-IV in the



TEXT-FIG. 17.—*Larifuga mantoni*. ♂: *a*, ocular tubercle; *b*, pedipalp femur from the side; *c*, pedipalp femur from above; *d*, patella, tibia, tarsus of pedipalp from below; *e*, chelicera from the side; *f*, segment I of chelicera from above; *g*, femur I. ♀: *h*, pedipalp femur from the side; *i*, chelicera.

middle with a pair of larger conical granules surrounded by a cluster of minute granules; area V with a transverse row of 5 enlarged conical granules occupying the middle portion of the segment, the central granule placed just half-way between the two conical granules of the preceding area, behind this row a continuous row of minute granules duplicated at the sides; free tergites I-III with a transverse row of 8-10 large conical granules and two transverse rows of minute granules, the one anterior, the other posterior to the row of conical granules, the anterior row further from the row of conical granules than the posterior one.

Ventral Surface.—Surfaces of coxae II-IV regularly covered with minute granules, these a little less dense in the middle; coxa I with larger conical granules, 2-3 at the anterior distal margin of the segment enlarged; sternum fairly wide and regularly triangular; sternites with a transverse row of conical granules, an anterior but no posterior row of minute granules.

Pedipalp.—Femur seen from above as in fig. 17, *c*, seen from the inner side as in fig. 17, *b*, the teeth stout and triangular; patella below with 2 small teeth near its outer apex; tibia and tarsus as in fig. 17, *d*, seen from below, the ventral surface of tarsus smooth.

Chelicera.—Segment I seen from above as in fig. 17, *f*, its distal edge with 2-3 teeth, the inner one largest, the outer smallest; inner surface of segment (fig. 17, *e*) shagreened; segment II with some large blunt teeth along its inner anterior surface.

Legs.—Femur I with ventral surface armed as in fig. 17, *g*, remaining legs unarmed; terminal section of tarsus II consisting of 3 segments; tarsal segments I, 3; II, 14-16; III, 4; IV, 4.

Dimensions.—Length of body 6, breadth 4, pedipalp 4.8 mm.

♀. *Colour* as in ♂; granulation as in ♂, except that the granules of the tergites and sternites are more clearly defined; surfaces of coxae more densely granular than in the ♂.

Pedipalp.—Femur as in fig. 17, *h*, seen from the inner side, the enlarged teeth less conspicuous than in the ♂; patella below with 2 conspicuous teeth on its inner side, 1 at its outer distal apex; tibia without granules on its ventral surface, with 3 stout triangular teeth on each side; tarsus with 3 stout triangular teeth on each side, stronger than those of the ♂.

Chelicera as in fig. 17, *i*, seen from the inner side; segment I with 2 teeth on its dorsal distal edge, the inner one the larger but considerably smaller than that of the ♂; segment II with rounded teeth

on its anterior inner surface, more rounded and less conspicuous than those of the ♂.

Legs.—Femur I armed on its ventral surface as in the ♂; tarsal segments I, 4; II, 14–15; III, 4; IV, 4.

Dimensions.—Length of body 5·8, breadth 4·1, pedipalp 3·7 mm.

Although this species agrees with *Larifugella* in the shape of the sternum and number of tarsal segments, it might equally well be placed in the genus *Larifuga*, on account of the division of the dorsal scute into quadrate areas by transverse rows of granules; this occurs in two species of *Larifuga*, *weberi* and *calcarata*. It also agrees with *Larifuga* in having the femur of leg I armed. For the present, therefore, I have placed it under *Larifuga* until its generic position can be definitely determined.

SUBORDER PALPATORES.

FAM. ACROPSOPILIONIDAE Roewer.

Genus CADELLA Hirst.

1925. *Cadella*, Hirst, P.Z.S., 1925, pt. ii, p. 1276, fig. 5, A, B, C.

1931. Syn. *Oonopsopilio*, Lawrence, Ann. S.A. Mus., vol. xxix, p. 470, fig. 66, a-e.

The genus *Oonopsopilio* described by me in 1931 is unquestionably synonymous with Hirst's genus *Cadella*, the description of which was unaccountably overlooked in drawing up the monograph of South African Opiliones. The species on which Hirst based his genus, however, remains separated from *Cadella* (*Oonopsopilio*) *africana* as set out in the key below.

Cadella spatulipilis n. sp.

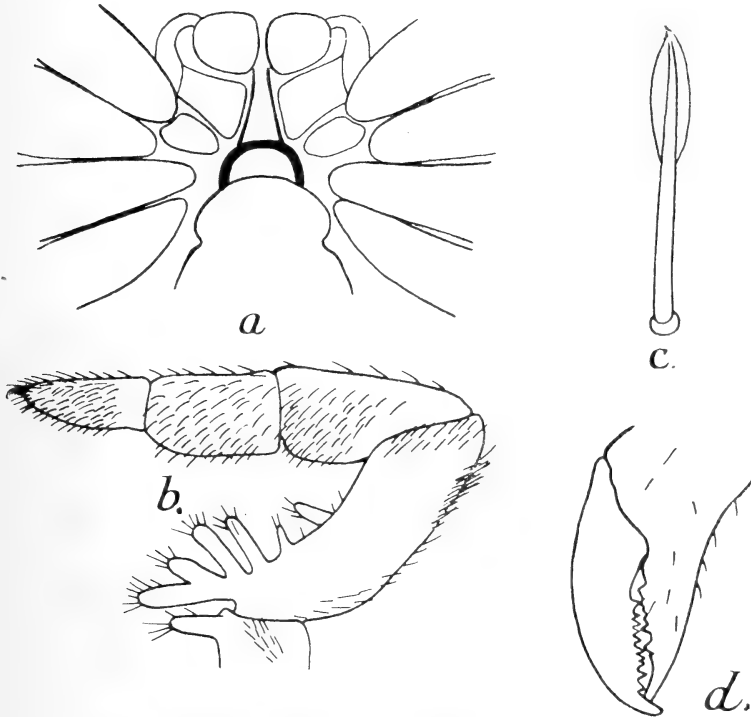
(Text-fig. 18.)

Types, 2 specimens, Jonkershoek, Stellenbosch.

Colour.—Anterior margin of carapace orange with some black markings; ocular tubercle posterior and mesially to the eye, black; below the ocular tubercle at the sides a silver white stripe separating the blackened portion of the tubercle from the edge of the carapace; dorsal surface of ocular tubercle between the eyes mottled reddish-brown; dorsum of body behind the ocular tubercle reddish-brown, mottled with silvery streaks and spots; ventral surface much lighter than dorsal surface, coxae white, darkened in their distal third,

sternites white with blackish symmetrical stripes. Legs brown, femora with a narrow white band in distal half, tibiae with narrow basal, middle, and apical white bands, the middle band more distinct than the others.

Ventral Surface.—Ventral surface of body in the region of the coxae



TEXT-FIG. 18.—*Cadella spatulipilis*. *a*, mouthparts and coxae; *b*, pedipalp; *c*, spatulate hair of pedipalp enlarged; *d*, claws of chelicera.

and mouthparts as in fig. 18, *a*; stigmata clearly visible, close to the posterior distal margin of coxa IV.

Pedipalp as in fig. 18, *b*, seen from the inner side. It differs from the appendages of *africana* and *capensis* in having modified hairs provided with a membranous fin-like expansion at their apices (fig. 18, *c*); these hairs occur over the whole surface of the various segments except for a patch at the sides of the trochanter and another at the dorsal distal apex of the femur, where the hairs are normal and pointed; a row consisting of a few hairs on the dorsal surface of the patella are also normal, being, however, stronger and more

spinelike than the other unmodified hairs; tarsus with a distinct though short claw.

Chelicera with the movable and immovable claws toothed as in fig. 18, *d*.

Legs.—Tarsal segments I, 15; II, 20; III, 15; IV, 17.

Dimensions.—Length of body 3.5 mm.

The specimens from Caledon cited in Ann. S.A. Mus., vol. xxix, p. 472, appear to be a variety of this species which I now name var. *caledonica*.

Colour.—The specimens have become much faded in alcohol but are apparently light brown above with a broad median longitudinal band constricted in the middle and with crenulated lateral borders; ventral surface light with brownish markings.

Pedipalp.—The basal ventral papilla bifurcate only at the apex; spatulate hairs on the various segments mixed with normal pointed ones, the two basal papillae with spatulate hairs, inferior surface of tibia and tarsus with mixed spatulate and pointed hairs, remaining hairs of the appendage simple and pointed.

Key to species of Cadella.

1. Pedipalp with spatulate hairs, pedipalp femur ventrally with 5 papillae, the basal one bifurcate *spatulipilis*.
 Pedipalp without spatulate hairs, pedipalp femur ventrally with 4 papillae, the basal one bifurcate 2.
2. Papillae of pedipalp femur very long and apically pointed . . . *capensis*.
 Papillae of pedipalp femur shorter and apically rounded . . . *africana*.

FAM. PHALANGIIDAE Simon.

SUBFAM. Phalangiinae Simon.

Genus RHAMPSINITUS Simon.

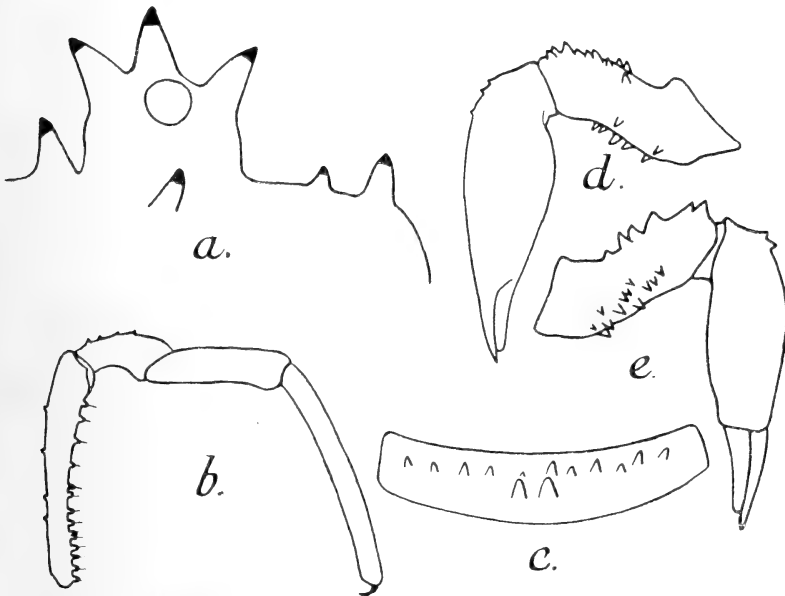
Rhampsinitus ceratops n. sp.

(Text-fig. 19.)

Types, 2 ♂♂, 7 ♀♀, Hogsback, Amatola Mts. The ♂♂ are perhaps not fully mature.

♂. *Colour*.—Dorsal surface of body brown, with a longitudinal median lighter stripe widening posteriorly and including the ocular tubercle anteriorly; proximal half of coxae white, distal half brown with light spots, genital operculum and sternites white with brown stripes and spots; legs brown, tibiae with some lighter bands.

Dorsal Surface.—Anterior margin of carapace in the middle with 2 toothlike spines, these larger than the other spines of the carapace, of which there are 5 or 6 on each side, including 1 laterally at the base of the ocular tubercle; ocular tubercle spined as in fig. 19, *a*, seen from the side; thoracic and abdominal tergites (fig. 19, *c*), each with a single transverse row of spines, these weaker at the sides but duplicated in the middle line, where there are usually 2 enlarged spines just anterior to the regular row, these enlarged



TEXT-FIG. 19.—*Rhapsinitus ceratops*. ♂: *a*, ocular tubercle; *b*, pedipalp; *c*, first abdominal tergite; *d*, chelicera from inner side; *e*, chelicera from outer side.

spines a little smaller than those on the ocular tubercle but larger than any of the other spines on the dorsum; thoracic tergites with 2 of these enlarged spines, abdominal tergites I and II with 2, III–V with only 1, the remaining tergites without enlarged spines in the middle.

Ventral Surface.—Coxae smooth, except I, which is provided with a few very weak granules; genital operculum and sternites quite smooth.

Pedipalp armed as in fig. 19, *b*.

Chelicera armed as in fig. 19, *e*, seen from the outer side, fig. 19, *d*, seen from the inner side.

Legs.—Femur I slightly incrassate, not armed with accessory teeth at its apex, with longitudinal rows of fairly strong spines along the edges which are, however, not sharply angled; remaining segments of leg I smooth; femora of legs II–IV spined, but more weakly so than in leg I; tarsal segments I, 40; II, 76; III, 37; IV, 34.

Dimensions.—Length of body 5·3, chelicera I + II = 1·5 + 2·7, pedipalp 5·5 mm.

♀. Dorsal surface with a constricted grey-brown marking, divided in the middle by a very distinct, narrow, white, longitudinal stripe, widening on the last 3 or 4 tergites. Ocular tubercle with much smaller spines than in the ♂; anterior margin of carapace with much smaller spines than in the ♂; transverse rows of spines on the thoracic and abdominal tergites much weaker than in the ♂, even the enlarged spines in the middle line inconspicuous, though certainly larger than the remaining ones; the whole of ventral surface, including coxa I, smooth. Pedipalp armed as in ♂. Chelicera smooth except for a few granules on the distal dorsal surface of segment I. Legs with much weaker spines than in ♂; femur I armed with spines which are not stronger but rather weaker than those of legs II–IV; tarsal segments I, 40; II, 77; III, 37; IV, 42.

Dimensions.—Length of body 7·3, chelicera I + XI = 1 + 2, pedipalp 3·7 mm.

The types, collected by Mr. J. Hewitt, are deposited in the Albany Museum, Grahamstown.

ANNALS

OF THE

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VOLUME XXX.

PART V, containing :—

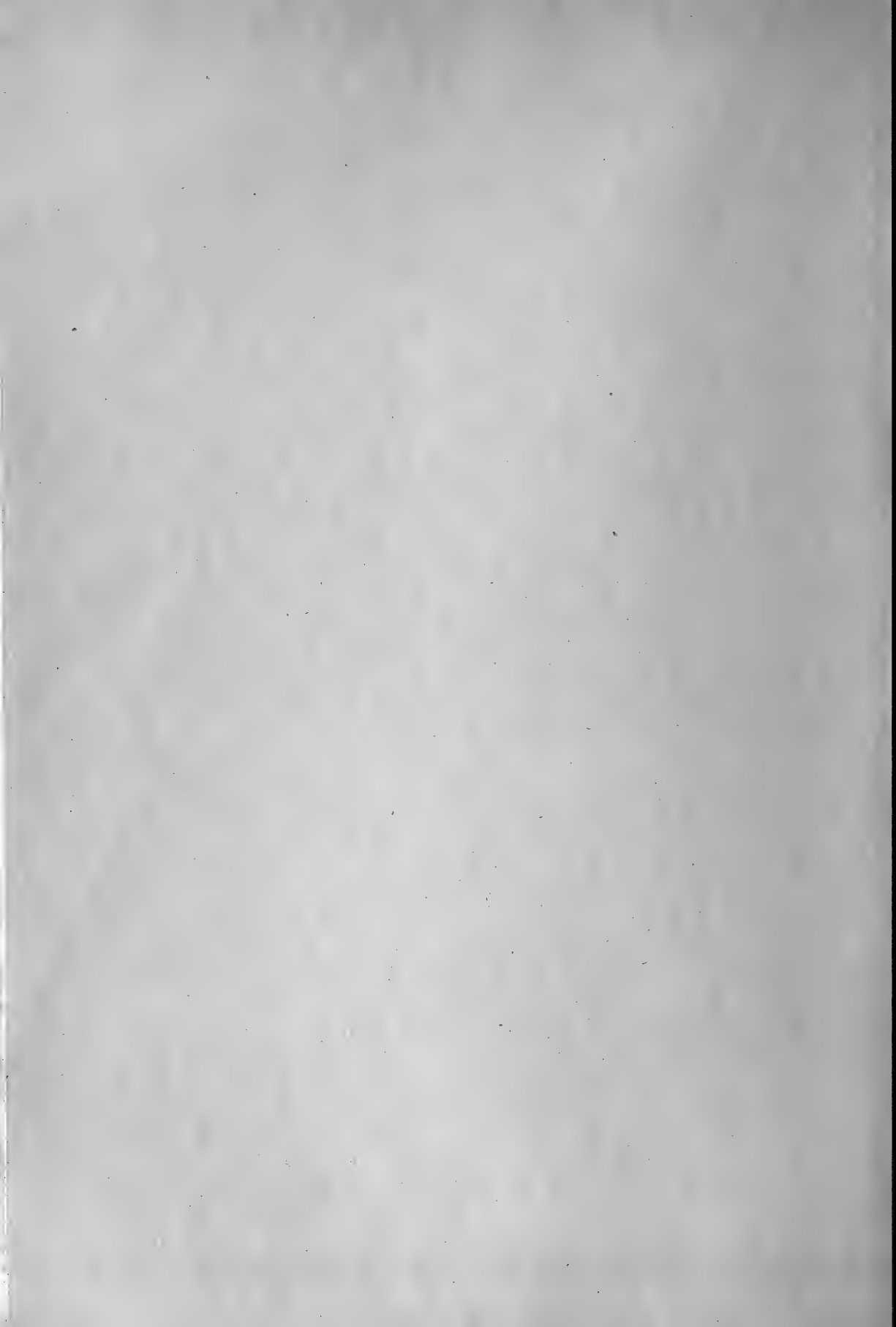
19. *The Fishes of the Family Mugilidae in South Africa.*—By
J. L. B. SMITH, M.Sc., Ph.D., Hon. Curator of Fishes,
Albany Museum, Grahamstown. (With Plates XV-XXII
and 17 Text-figures.)

20. *Notes on South African Marine Fishes.*—By K. H. BARNARD,
D.Sc., F.L.S., Assistant Director. (With Plates XXIII-
XXV and 7 Text-figures.)



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19. *The Fishes of the Family Mugilidae in South Africa*.—By J. L. B. SMITH, M.Sc., Ph.D., Hon. Curator of Fishes, Albany Museum, Grahamstown.

(With Plates XV–XXII and 17 Text-figures.)

[Members of the family *Mugilidae*—known in South Africa as “Harders”—are an important edible commodity. Pappe refers to their value, and an enthusiastic praise of them occurs in the memoirs of Lady Anne Barnard. From the culinary point of view one species of Harder appears to be as good as another, but for scientific purposes it is important to have the species occurring in our waters defined as accurately as possible. In this paper Dr. J. L. B. Smith—a worthy successor of Dr. Andrew Smith in the early part of last century—has tackled a very difficult problem in systematics, which previous writers have left severely alone.—Ed.]

Family MUGILIDAE.

The South African species all fall within the single wide genus *Mugil* Linn.

Genus MUGIL Linn.

1861. Günther, Cat. Fish. B.M., vol. iii, p. 409, and p. 466 (*Myxus*).
1884. Jordan and Swain, Proc. U.S. Nat. Mus., vol. vii, p. 261 (*Liza*).
1916. Boulenger, F.W.F. Africa, vol. iv, p. 78.
1920. Athanassoupoulos, Ann. Mus. Civ. Genoa (3), vol. viii, p. 254 ff.
1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 229, and p. 264 (*Myxus*).
1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 302, and p. 311 (*Myxus*), and p. 1023.

Body elongate, sub-cylindrical, more or less compressed posteriorly. Head usually somewhat depressed, more or less cuneiform in transverse section, with rounded apex below, generally completely scaly. Scales usually ctenoid, sometimes cycloid, ventral scales more markedly denticulate. Sometimes a secondary cycloid squamation in the investing integument of the scales. No lateral line, but most scales with one or more pits or canals, sometimes more numerous on dorsal scales. Mouth small, terminal or sub-inferior, protractile. Maxilla almost or entirely hidden beneath preorbital, excluded from margin of upper jaw. Upper lip narrow or fleshy, with or without

papillae. Minute recurved teeth, generally compressed and apically dilated, unicuspid, tricuspid, or spatulate, in one or more rows in upper jaw, present or absent. Very minute slender pointed teeth in lower jaw rarely present. Villiform teeth present or absent on vomer, palatines, pterygoids, and tongue. The buccal membrane sometimes with apically dilated cilia. A transverse concavity before the vomer, obscured in some species. Tongue adnate to floor of mouth.

Eyes fairly large, usually with adipose eyelids, rudimentary or highly developed, better developed in adults.

Two dorsal fins; the first, of 4 pungent spines, with a pointed basal scaly process inserted near middle of body, membrane from last ray joined to body. Second dorsal of 1 weak spine and 7-10 rays, inserted above last fourth of body. Anal of 3 weak spines and 8-11 rays, inserted below second dorsal. Pectorals inserted slightly or considerably above middle of side, more or less falcate, with or without an elongate scaly axillary process. Ventrals abdominal, joined by a membrane to the body and to one another. An elongate cuneiform interventral scaly process. Caudal feebly emarginate to forked. Fins, except first dorsal, more or less scaly.

Third and fourth upper pharyngeals fused, enlarged, with convoluted adipose base. Gill-openings wide, membranes separate, free from isthmus. Gill-rakers very numerous, long and close-set; lower pharyngeal rakers functional. Stomach tough and muscular, gizzard-like; pyloric caeca few.

Mugil sensu lato is one of the earliest described genera of fishes, but the natural relationships of the species appear to be but poorly understood, and more or less unsatisfactory division of the wide genus has several times been proposed.

Myxus Gnthr. (*loc. cit.*) was proposed for species with teeth in the jaws, and (sometimes?) on the palate. The validity of this differentiation has been accepted or rejected by systematists without precise definition of the criteria upon which they base their opinions. It is even not unusual to find an author stating that specimens of *Mugil sensu stricto* (*i.e.* accepting *Myxus*) have teeth in the jaws. Further, systematists frequently imply that teeth are absent from the palatal bones of certain species, whereas even a casual examination of their specimens would reveal that teeth are present.

The inaccuracy of many statements about the dentition is probably in part due to the relatively small mouth of *Mugil* species, which renders the examination of the palatal bones, especially in small

and preserved specimens, a troublesome matter. In illustration may be quoted the fact that I have found no mention of lingual teeth, which are by no means infrequently present.

In the South African species there appear to be all degrees between the entire absence of teeth, and the state where most of the normally dentigerous bones are fully dentate. Many of our species have teeth in the jaws, and on the palatal bones, at least as well developed as those present in, e.g., *Elops* Linn. In this latter genus the mouth is large.

In so far as our species are concerned, division of *Mugil sensu lato* on the nature of the dentition alone would be not only of questionable value, but also exceedingly difficult to define and justify. It is not unlikely that this may well apply to all cases where *Myxus* has been recognised.

Jordan and Swain (*loc. cit.*) have proposed the genus *Liza* for species which do not possess adipose eyelids (genotype: *capito* Cuv.), while to *Mugil sensu stricto* are assigned those with eyelids. It has already been pointed out by Jacot (Sci. Rep. Tohok. Imp. Univ., 1930, vol. v, No. 4, p. 827) that division on this feature is of doubtful value, since there is to be found almost every degree between obsolete and fully developed eyelids. Further, it may be indicated that adipose eyelids are, sometimes at least, better developed in the adult than in the juvenile stadia, and, also that as far as the South African species are concerned, the adults of all possess definite, if not always highly developed, eyelids.

It may be noted that species (such as *cephalus* Linn.) which possess well developed eyelids probably always have an edentate vomer, fairly concave anteriorly, while the transverse concavity anterior to the vomer is not usually obscured (all of the American species of *Mugil* appear to be of this type). These differences are nowhere constant and sharp, nor can they be considered as a basis upon which the genus may be divided.

As far as the South African species are concerned, it would be exceedingly difficult to justify the separation of the three with well developed eyelids from the remainder, and I do not propose to attempt it. (But see note on scaling of *cephalus*, p. 19.)

No representatives of the closely related genera *Agonostomus* Benn. and *Cestraeus* C. and V., appear to have been found in our area. The latter at least appears to be well differentiated from *Mugil*.

The majority of museum collections of *Mugil* species appear to be in a somewhat chaotic state, and few systematists care to undertake positive identifications upon which reliance may be placed.

The early descriptions are hardly ever of real diagnostic value, and the diagnoses of many species cannot be anything but provisional. Added to this, differentiation between the species of this genus has proved to be one of the most difficult problems which face the systematist; many of the features which in other groups provide a basis for differentiation here appear to vary little between the different species. The habits and environment of the different species show little variation. It is found that such cases of obscured differentiation sometimes occur in genera in which there is this uniformity of habit and of habitat (e.g. *Epinephelus* Blch.).

In recent literature there is a general tendency to reduce the number of nominal species of *Mugil*. At the same time, it is remarkable that the differentiation of those closely related is still frequently based chiefly upon features, which can, by the examination of large numbers of specimens, be shown to vary widely within any one, and to overlap between related, species. The present confusion may be attributed partly to the fact that where ordinary features have apparently failed to show differentiation between what have quite obviously been different species, systematists have assigned a purely fictitious value to characters which are inconstant and unreliable. The depth of the body, and of the caudal peduncle, the position of insertion of the pectorals, and too restricted and undefined limits for scale-counts, are, among others, comparatively useless features in this genus. On the other hand, it is singular to find how many most significant characters have been entirely overlooked. The nature of the scales and of the teeth are of importance, but have not received the attention they merit. The changes which take place with increase in size have not been properly considered, and many nominal species may prove to be merely different stadia of others. It is remarkable that the highly characteristic form of the ventral fins has not, in so far as I can determine, been regarded as worthy of special description. This is a feature more of generic than specific significance.

Where significant features have been overlooked, it is not unusual to find that two closely related species may be confused. This is probably a frequent occurrence with *Mugil* species, and is in part due to the fact that the features of doubtful validity upon which differentiation is based often vary widely, and the limits can actually never be clearly defined.

A case in point is that of *auratus* Risso, which has been included in our fauna-list upon the authority of Boulenger (*loc. cit.*, p. 86),

who identified * as this species a specimen in the South African Museum from East London. In this he was followed by Barnard (*loc. cit.*, p. 308). Specimens which agree more or less with the usual diagnosis of *auratus* have been found to be the most abundant form from Knysna eastwards. When numbers of these were examined, it was obvious that two well-differentiated species were present, neither of which is *auratus*, nor can either be identified with any existing species. The one species (*canaliculatus* n. sp.) is easily recognised by the multicanalicate dorsal scales, the other (*tricuspidens* n. sp.) by the relatively large tricuspid teeth, besides many other features in each case.

The South African species have stood in need of critical revision. Of the fourteen (incl. *Myxus*) hitherto admitted to our fauna-list, four, viz. *auratus* Risso, *speigleri* Blkr., *saliens* Risso, and *cunnescius* C. and V., have now been found not valid, while *strongylocephalus* Rich., *oligolepis* Blkr., *tricuspidens* n. sp., and *canaliculatus* n. sp. have been added, and *euronotus* A. Smith, up to now regarded as a synonym of *saliens*, has been revived. *M. diadema* G. and T. has been found to be identical with *compressus* Gnthr., and *ceylonensis* Gnthr. with *buchanani* Blkr. *Myxus barnardi* G. and T. has been found to be a synonym of *Mugil cephalus* Linn.

It may be as well to state that of definite purpose there have been omitted from most of the descriptions those details which, by the examination of a number of specimens, have been found to vary widely, and which can have but little significance. Among these may be mentioned the nature of the dorsal and ventral profiles, of the interorbital, and the degree of compression of the body. Variation in these may result from different methods of preservation, as well as in part from varying degrees of sexual maturity.

It should be emphasised that a critical revision of *Mugil* species, based upon an adequate world collection, is long overdue. Such a revision would be of the greatest value to systematists, if only because *Mugil* is almost cosmopolitan in distribution, and local specimens are contained in probably every Museum collection throughout the world.

It is frankly admitted that the identification of many of our species with those from other parts is provisional only. Not only are the majority of descriptions in the somewhat scanty literature available to me of little diagnostic value, but it has not been possible to secure

* It may be remarked that there is no record of this identification in the S.A. Museum. Boulenger identified other species from specimens in this Museum, of which records have been kept.

the desired number of identified specimens from other parts for examination and comparison. The final pronouncement of the identity of our species must be left to some worker who has at his disposal adequate world material.

The chief aim of the present work has been to establish clearly the differentiation of the South African species.

It will be noticed that there are very few positive statements about synonymy, where such would be based upon descriptions only. I have nevertheless made an exhaustive study of descriptions of our, and of related, species, but in most cases the lack of significant detail would render opinions based upon these of little value.

The localities given in the present work are those from which the specimens were actually obtained. The sizes given are those of the specimens examined.

Certain characteristic features of *Mugil* species which have received little or no attention from systematists, but which appear to be of considerable taxonomic significance, are described below.

GROWTH CHANGES.

There is the usual variation with age in the relative size of the eye, and of the dimensional relationships of the parts of the head. The shape of the dorsal and of the anal fin undergoes considerable modification with growth in some species, e.g. *buchanani* (q.v.). The anterior dorsal and anal rays, the caudal lobes, the pectorals, the pectoral axillary scale, and the adipose eyelids, all appear to increase somewhat in relative size with growth. The exposed surface on the chin increases in size in some species, e.g. *buchanani*, and the scaling on the vertical fins appears to become denser. The origin of the first dorsal frequently appears to move towards the snout, as if there is a somewhat greater increase of the posterior than of the anterior half of the body with growth.

SCALES.

The scales may be cycloid or etenoid, and in some cases (e.g. *euronotus*) both are present. The denticulations are generally larger, and greater in extent, on scales from the ventral area. The ventral scales are always more elongate than those from the dorsal area.

The form of equivalent scales has been found to be sometimes highly characteristic, and in several cases immediately diagnostic. The multicanalicate scales of *canaliculatus* enable this species to

be distinguished at a glance from all others from South Africa. The dorsal scales of *capito* are, from the early mid-juvenile stadia, denticulate, whereas those of the closely related species *euronotus* are cycloid. Further, the mucus canals of the former species are long and narrow, whereas those of the latter are short and wide.

The young of those species I have examined have cycloid scales, the denticulations appearing as a small mid-posterior patch, which rapidly extends over the whole area (Pl. XIX, A-E, for *capito*).

Two species, *cephalus* Linn. and *strongylocephalus* Rich., are remarkable in possessing two distinct squamations. The main scales are large. In the investing mesodermal integument is found a secondary squamation of minute cycloid scales, which are visible upon the surface of the primary scales (Pl. XV, A and B). This is especially well developed over the occipital area, while, in *cephalus*, the largest of these scales of secondary origin are to be found in the thickened dermal investment of the axillary scales of the pectoral and ventral fins.

Enlarged photographs of the scales of most of the South African species are reproduced in Plates XVII-XX, XXII.

SCALY BASAL PROCESS OF FIRST DORSAL.

One feature of significance is the relative length of the pointed scaly process at the base of the first dorsal fin. Not only does the relative length of this appear to be remarkably constant at all stages in any one species, but it differs between the species, so as to afford in some cases a reliable guide to differentiation. Its use was apparently first proposed by Ninni * (Considerazioni sul genere *Mugil*, Venezia, 1909), but I have not seen this paper, and do not know how he proposed to use it. Later authors have apparently not considered this feature of any value.

DENTITION.

The teeth are always very small, and are in some species very minute, so as to resemble partly or wholly ossified dermal cilia, but they are always, in the upper jaw at least, definitely sub-labial, with the bases adnate to the premaxilla. These premaxillary teeth vary both in size and shape, and have been found to be frequently characteristic, and in some species immediately diagnostic: the tricuspid teeth of *tricuspidens* are larger than those of most others, and enable this species to be easily distinguished.

* *Vide* Athanassoupoulos, Ann. Mus. Civ. Gen., 1920, xlviii, p. 255.

The teeth appear to be equally developed at all stages. In older individuals they may be partly hidden by the development of infra-labial spongy tissue, which has probably given rise to the idea that teeth are sometimes better developed in the young, since they are then frequently exert and more easily visible.

In order to determine the nature of the premaxillary teeth, when they are partly or completely hidden, the following procedure has been found satisfactory. With a sharp pair of fine scissors a thin strip of the upper jaw is snipped off, and soaked for some minutes in rectified spirit. The strip is then placed on a slide and allowed to dry thoroughly. This causes retraction of the enveloping tissue, and leaves the teeth clearly visible.

The teeth possess elongated, dilated, bases.

The teeth of certain species have brown apices. This applies especially to those such as *euronotus* and *tricuspidens*, in which they are apically dilated, like those of the fresh-water *Cichlidae*. It is interesting to note that these species are almost wholly fluviatile.

Enlarged photographs of characteristic forms of premaxillary teeth are reproduced in Plate XVII, C-G.

Palatal and lingual teeth are usually villiform or obtusely conical. In old specimens they may be obscured by a layer of mucus, but may be detected by means of a dissecting needle. Those on the tongue are usually present in adjoining patches round the anterior margin, and occasionally also over the slight median ridge of this organ (fig. 8, A).

VENTRAL FINS.

As has been noted previously, the form of the ventrals is highly characteristic, and may prove of use as a generic feature.

The last ray of each fin is connected for a part of its length to the body by a membrane, which is also joined to that from the opposing fin (fig. 1, A and B). This forms a hollow pouch, sub-triangular in cross-section. Over this pouch, and of the same length, or shorter, projects a cuneiform inter-ventral scaly process, consisting usually of five or six series of scales, the apical scale being elongate and pointed (fig. 1, sp.).

The precise function of this peculiar structure is not clear. It is possible that the increased rigidity imparted to the distended ventrals may play some important part in the leaping powers of these fishes. When the fish moves rapidly, the pressure of the water upon the inclined plane of the obliquely extended ventrals would tend

to divert the anterior part of the body upwards. The larger the ventrals, and the more anterior their insertion, the greater will be this effect.

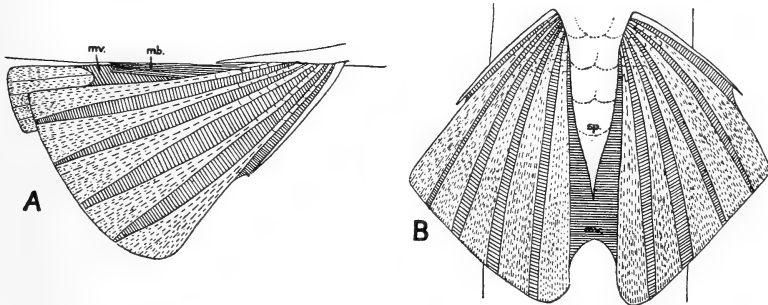


FIG. 1.—Diagram to show the structure of the ventral fins of *Mugil* species—A, lateral view; B, ventral view. mv, membrane connecting ventrals*; mb, membrane joined to body; sp, interventral scaly process.

GILLS AND GILL-RAKERS.

The gill-rakers to the three inner arches are set at right angles to the vertical plane of the gill-arches. The rakers themselves are extremely close-set and form a plane surface, the rigidity of each plane being assisted by the enmeshing of setiform processes which are present on the adjacent basal portions of each raker. The rakers do not interdigitate with those from the adjacent arch, but those of each side of each arch form a gently curved edge, which coincides exactly with that from the adjacent arch (Pl. XV, C).

The lower pharyngeal area is divided by a raised medio-longitudinal ridge, of which a longitudinally grooved anterior dilation is immediately posterior to the basibranchial cartilage. Each half of the lower pharyngeal area is concave, the enlarged upper pharyngeals fitting exactly into the two concavities. The lower pharyngeal bones are themselves very thin, long, curved, and fairly narrow: along the middle of the upper surface of each is a cartilaginous ridge, which bears on each side of the apex, as a continuous curved plane, lamellae exactly similar in structure to, but longer than, the rakers on the functional gill-arches. The edge of the exterior series meets that of the inner series of rakers from the inner functional gill-arch. The inner edge of the inner series of these lamellae is adnate to the cutaneous margin of the medio-longitudinal pharyngeal ridge, while

* Slightly exaggerated.

the lower margins of both series of lamellae are adnate to the upper margin of the pharyngeals, the outer series projecting some distance into the branchial cavity (Pl. XV, C).

It may be presumed that these pharyngeal lamellae have been developed from the true rakers originally present on the arch now modified to form the pharyngeals. If so, it is an interesting example of a surviving integral portion of a highly modified structure, having retained the original form and function despite the profound structural and functional modification of the main structure.

DIMENSIONAL RELATIONSHIPS, ETC.

In order that dimensional relationships and scale-counts shall have their full value, it is essential that the precise limits should be defined. In the present paper the following have been employed:—

Length of Head.—This is measured with dividers in a straight line from the tip of the retracted snout to the hindmost point of the opercular margin on the level of the upper margin of the pectoral base, *i.e.* it is measured diagonally, and not in profile.

Head without snout is measured from the hind margin of the head to the anterior margin of the orbit.

Length of Pectoral.—This is employed as an important diagnostic character, and is measured from the body to the tip of the pectoral, when the latter is held at right angles to the side.

Caudal Base.—This is taken as the base of the mid-caudal rays, which is obscured by the scaling. The body scales diminish very little in size up to this point, the scales on the basal portion of the rays being generally abruptly smaller. In fresh specimens the bases of the rays are easily visible if the caudal be distended and viewed against a light. In preserved specimens this point is less easily ascertainable, but may generally be determined by similar means. The diagnostic scale-counts employed in the present work may quite easily be made with sufficient accuracy.

Scales : Lateral Series.—This is taken as the number of scales in the first continuous series above the axil of the pectoral, from directly above the hind margin of the head (see *Length of Head*, above) to the caudal base (*q.v.*). The first series above the axil is not usually continuous, being interrupted at the 3rd or 4th scale, whereas the next series above is usually regular, often starting from above the hind margin of the head in a gentle downward curve.

Scales : Transverse Series.—This count can have but little signifi-

cance, since the number of transverse series varies very little between the species. The counts given in this work are taken from before the origin of the first dorsal to the mid-line of the belly.

Scales: Predorsal.—All previous counts of the predorsal scales have been taken from the origin of the first dorsal to the snout. Since the dorsal cephalic squamation is rarely ever regular, counts between these limits are of little value in the absence of precise definition of the method of counting.

The number of predorsal scales does not appear to be of any special significance, as apart from the number in lateral series, but the number of series between the origin of the first dorsal and the point above the hind margin of the head has in each case been recorded.

Angle of Lower Jaw.—This does not alone appear to be of any special significance, but as most workers make some statement about the nature of this feature, it appears advisable to follow suit. The majority of statements appear to have been based upon casual estimations, which can have

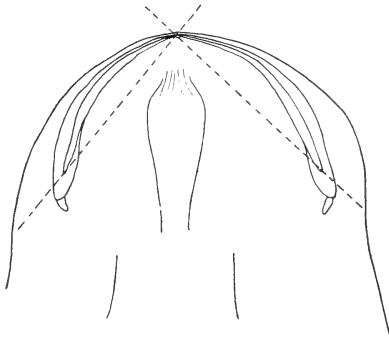


FIG. 2.—Diagram of chin of a specimen of *Mugil*. To show how the angle of the mouth is taken.

but little value, and actual diagrams in illustration of the angle of the mouth do not infrequently fail to agree with corresponding statements. I have therefore judged it wise to record the actual angle subtended by the corners of the mouth at the symphysis, which is not affected by the nature of the outline of the jaw, this being sometimes rounded, and sometimes angular. This angle has been measured by means of a simple goniometer devised and constructed for this purpose.

Origin of first Dorsal (1) to Snout, (2) to Caudal Base, (3) to Hind Margin of Caudal Rays.—These are measured with dividers, one point at the anterior point of the base of the first dorsal spine, and the other (1) at the tip of the snout, (2) at the mid-point (lateral) of the caudal base, and (3) at the actual hind margin of the mid-caudal rays, respectively.

Length of Pointed Basal Scaly Process of First Dorsal.—This is measured from the anterior point of the base of the first dorsal spine

to the hindmost point (apex) of the scaly process. When the two processes are unequal in length, the longer is measured.

Length of snout is measured obliquely from the tip of the snout to the anterior margin of the orbit.

Total length is measured from the tip of the snout to the hind margin of the mid-caudal rays.

Other measurements are taken in the usual manner.

The interventral scaly process varies very little in relative length between the species, averaging three in head.

Key to the South African species.

- I. Adipose eyelids well developed, the posterior covering more than half of the posterior width of the iris, in some cases reaching to hind margin of pupil.
 - A. Scales 37-42. Pectorals not longer than head without snout.*
 1. Anal rays 7-8. 2nd dorsal not scaly. Anterior eyelid well developed *cephalus*.
 2. Anal rays 9. 2nd dorsal scaly. Anterior eyelid feeble *robustus*.
 - B. Scales 33-35. Pectorals longer than head without snout * *strongylocephalus*.
- II. Adipose eyelids narrow or rudimentary, better visible in adults, round the outer margin of the eye, covering not more than half of the posterior portion of the iris.
 - A. Prominent papillae in several series on lower margin of upper lip, which is very deep at snout tip. (Scales 37-40) *crenilabis*.
 - B. No papillae on upper lip, which is not, or scarcely, more than $\frac{1}{3}$ of eye deep at snout tip.
 1. Scales 41-49.
 - a. Pectorals not longer than head without snout.* Palatine teeth present.
 - x. Scale at base of first dorsal 6.5-8 in distance from origin of first dorsal to snout tip. Soft dorsal completely scaly *euronotus*.
 - y. Scale at base of first dorsal 4-5 in distance from origin of first dorsal to snout tip. Soft dorsal not scaly posteriorly *capito*.
 - b. Pectorals longer (in adults much longer) than head without snout.* No palatine teeth.
 - x. Teeth comparatively large, tricuspid. Pectorals 1.2-1.3 in head. Maxilla well exposed *tricuspidens*.

the two main groups. The method here employed obviates this difficulty. In the case of *robustus* the eyelids shrink on preservation, and might not be accounted large enough for the species to fall in Group I (see note under *robustus*).

Another Key, embracing five Indo-Pacific species likely to be found here, will be found at the end of this paper.

Mugil cephalus Linn.

(Plate XV.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 418 (*constantiae*), and p. 419 (*cephalotus*).

1888. Day, Fish. India, p. 353, pl. lxxv, fig. 3 (*oeur*).

1916. Boulenger, F.W.F. Africa, vol. iv, p. 82, fig. 48 (*oeur*).

1918. Athanassoupoulos, Ann. Mus. Civ. Gen. (3), vol. viii, p. 264.

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 253.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 302, and p. 311 (*Myxus barnardi*).

1930. Jacot, Sci. Rep. Imp. Univ. Tohok. (4), vol. iv, No. 4, p. 825 ff.

Snout very broad, bluntly rounded or obtusely angular. Depth 3·5–4, length of head 3·3–4 in length of body. Eye 3·8 (Juv.)–5, snout 3·3–4·8, interorbital width 2–2·4, postorbital length 1·8–2 in length of head. Adipose eyelids well developed, completely encircling pupil, exposed surface of iris small or none (adult), aperture in membrane round or vertically elliptical. Nostrils 2·5 in eye diameter apart, posterior as far from front margin of eye as anterior from profile of snout tip. Lower margin of preorbital not bent or notched, obliquely truncated, maxilla almost or quite concealed, exposed portion increases with age. Angle of lower jaw 65–88°, outline of lower jaw sub-angular, rounded, or undulate. Symphysial knob double. Upper lip thin, width at apex of snout 6 in eye. Curved compressed teeth in one, few, or many series in each jaw. Villiform teeth on pterygoids. Palatines, vomer, and tongue edentate. Prevomerine groove distinct. Exposed area on chin long and wide.

D IV+I, (6–)8. First dorsal inserted 1·0–1·1 times further from caudal base than from tip of snout, 1·3–1·4 times as far from the hind margin of the mid-caudal rays as from the snout tip. First spine 1·6–1·8, base of first dorsal 2·0–2·5 in head. Distance from origin of first to origin of second dorsal 1·0–1·3 (J.) in head. First dorsal inserted above the 13th–14th, second above the 24th–26th lateral scale. Pointed sheath scale extends behind origin of first

dorsal 2·8–3·8 in head, 2·6–3·0 in distance from origin of first to origin of second dorsal, 5·3–6·4 in distance from origin of first dorsal to snout tip. Longest soft ray 1·6–1·8, base of second dorsal 2·0–2·6 in head. Last ray much longer than penultimate, edge of fin concave. Second dorsal scaly basally only.

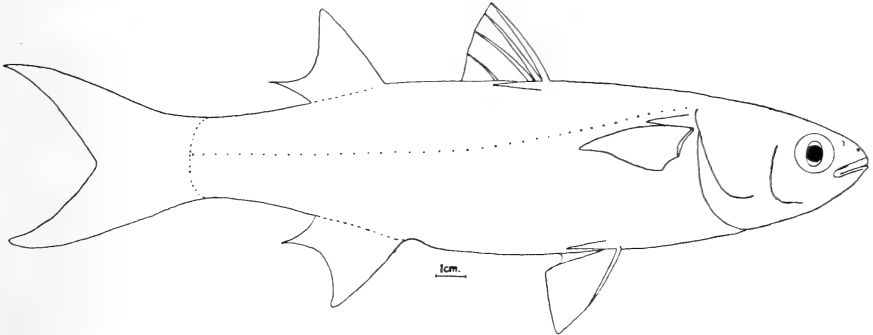


FIG. 3.—*Mugil cephalus* Linn.

NOTE.—In this and other text-figures of species, the lateral row of dots indicates the number and disposition of the lateral rows of scales.

The dimensional relationships involving the length of the head may appear to differ between the text and the figures, but the head in the former is not measured in profile (see p. 596).

A III, 8. Inserted in advance of second dorsal, below the 22nd–25th lateral scale. Longest ray 1·5–1·8 in head, shape of fin similar to that of soft dorsal. Scaly for anterior $\frac{3}{4}$.

P 17, 1·3–1·5 (J.) in head, tip reaches to the 10th–12th lateral scale. Inserted 2·3–3·5 times as far from the ventral as from the dorsal profile. Axillary scale long and pointed, 3·3–4·8 (J.) in head.

Ventrals 1·5–1·6 in head, inserted below in advance of, behind, or at, midway between origin of first dorsal and hind margin of head. Edge of fin truncate. Axillary scale 3·2–4 in head.

Caudal deeply forked, upper lobe longer, increasing with age, mid-rays 1·7–1·9 in head.

Scales ctenoid, predorsal scales 1·0–1·2 times wider than long (Pl. XV, A). Mucus canal long and narrow, often oblique. Most scales, especially those on occipital region, and axillary scales, with a superimposed secondary squamation of minute cycloid scales, developed in the integument, more noticeable in large specimens *

* I have examined specimens from Japan and America, and this secondary scaling is well developed, indicating that it is characteristic of the species and not confined to South African specimens.

(Pl. XV, A and B). Lat. ser. 39-42, l.tr. 14-15, 2 cheek scales, 13-14 predorsal to above hind margin of head.

Colour.—Silvery, darker above. Sometimes longitudinal stripes. Fishes from brackish water generally darker in colour.

Localities.—Lakeside (Cape Peninsula), Knysna River, Kabeljaauws River, Port Elizabeth (Zwartkops River), Kowie River, Great Fish River, Buffalo River, Mazeppa Bay, Durban, Sinkwazi, Kosi Bay. Also Japan, Peru, Chesapeake Bay (N. America).

Length.—Up to 630 mm.

Thirty-four specimens, from 55 mm. up, examined.

The synonymy of this species is rather complex. *oeur* Forsk. is regarded by most authors as conspecific with *cephalus*, but Boulenger (*loc. cit.*) regards the former as distinct in that the angle of the lower jaw is acute, whereas that of *cephalus* is stated to be obtuse. I have seen a juvenile specimen in the S.A. Museum which Boulenger identified as *cephalus*. This specimen has the mouth open, and it appears as if the mandibles are set at an obtuse angle, whereas when the mouth is closed the angle is 84° . I have seen no specimens in which the angle of the mouth is obtuse. It is curious that Günther (*loc. cit.*) gave no diagram of the mouth of *cephalus*, or of related species stated to have a mouth of obtuse angle, whereas he gave numerous diagrams of mouths of acute angle.

I have examined several specimens of *cephalus* from America (kindly donated by Dr. George S. Myers of the U.S. National Museum), and these are in all respects identical with ours. The angle of the mouth falls within the limits of variation in our specimens.

M. cephalus (as here defined) is quite obviously a somewhat polymorphous species. In so far as I have observed, it is almost always fluvatile, and does not commonly occur in the sea. It is possible that purely local forms may show minor variations from the general. The teeth in the jaws, the extent of the exposure of the maxilla, and the shape of the mouth are all extremely variable. In some specimens there is a single series of teeth, while others from the same locality have several or many rows in both jaws. The angle of the mouth varies from $65-88^{\circ}$, while the lower jaw may be sub-angular, rounded, or anteriorly undulate. Further, the angle of the mouth does not, in my specimens, become more obtuse with age. Some of the largest have the angle $65-70^{\circ}$.

I have endeavoured to find some constant basis among these variations for the establishment of sub-species, but there appears to be no combination of these, or of these with other characters, which

would justify this step. With more intensive study it may be possible to discover combinations of features which will establish definite sub-species. It is not unlikely that a very detailed study of specimens from all parts of the world would probably yield interesting results.

The extraordinary secondary cycloid squamation briefly described above alone merits special attention, and may ultimately prove of importance in the division of the genus, especially as it is present in *strongylocephalus*, which also possesses well-developed eyelids. These smaller scales are quite obviously ossified, and mesodermal in origin.

Myxus barnardi G. and T. is undoubtedly merely a juvenile *cephalus*. Barnard (*loc. cit.*) suspected this, but, possibly because the specimen is damaged, missed the scaly process which is present in the axil of the one undamaged pectoral. This process is always much smaller in the very young stadia.

M. cephalus attains a large size. In brackish vleis, and in the quiet upper reaches of lagoons and estuaries, specimens up to ten pounds in weight are not infrequently encountered. This species possesses very considerable leaping powers, which are not, however, as great as those of *tricuspidens*, while the type of leap is also different: *cephalus* leaps with the head well up, and the body curved, whereas the former species jumps much further, with the body more or less straight and parallel with the surface of the water.

Mugil robustus Gnthr.

(Plates XXI, A, and XXII, A, B.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 432.

1916. Boulenger, F.W.F. Africa, vol. iv, p. 92, fig. 54.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 305.

Body markedly robust anteriorly, tapering posteriorly. Snout fairly broad, bluntly rounded, upper lip forms oblique truncated margin. Depth 4.0, length of head 3.9 in length of body. Eye 4.1-4.3, snout 3.7, interorbital width 2.5, postorbital part of head 1.8 in length of head. Adipose eyelids very fragile, but well developed, especially the posterior, which extends almost to the hind margin of the pupil; the anterior covers about half of the width of the iris. (With preservation the eyelids appear to shrink considerably.) Nostrils 2.8 in eye diameter apart, the anterior as far from snout tip profile as the posterior from the front margin of the eye. Lower margin of preorbital not notched, sharply bent downwards over the angle of the mouth, end scarcely serrate, slightly convex. Maxilla

completely concealed. Angle of lower jaw $110-112^\circ$; outline of jaw angular. Symphyseal knob single. Upper lip fairly thin, width at apex of snout 4 in eye. No teeth in any part of mouth. Prevomerine groove well marked. Exposed area on chin long and very narrow.

D IV + I, 8. First dorsal inserted 1.05–1.08 times further from caudal base than snout tip, 1.4 times as far from the hind margin of the mid-caudal rays as from snout tip. First spine 1.7, base of first dorsal 1.9–2 in head. Distance from origin of first to origin of second dorsal 1.0–1.1 in head. First dorsal inserted above the 12th, second above the 23rd–24th lateral scale. Pointed sheath scale extends behind origin of first dorsal 2.3–2.4 in head, 2.2 in distance from origin of first to origin of second dorsal, 1.3 in postorbital part of

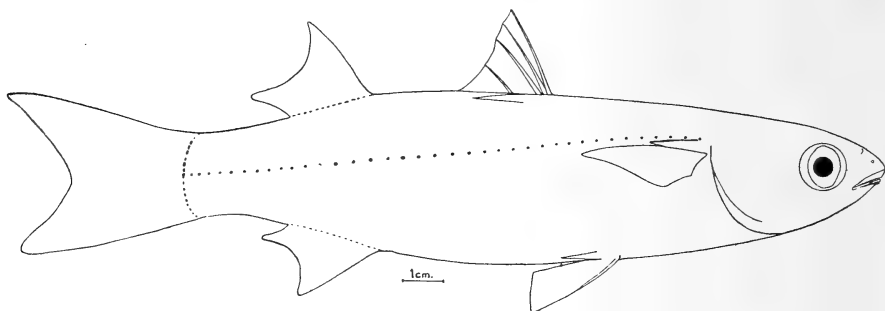


FIG. 4.—*Mugil robustus* Gnthr. (see note, fig. 3).

head, and 4.3–4.4 in distance between origin of first dorsal and snout tip. Longest soft ray 2.0, base of second dorsal 2.3–2.5 in head. Last ray slightly longer than penultimate. Fin scarcely falcate, edge concave; completely scaly.

A III, 9. Inserted in advance of second dorsal, below the 22nd–23rd lateral scale. Longest ray 2.1 in head; shape of fin similar to that of soft dorsal; completely scaly.

P 15, 1.4–1.5 in head, shorter than head without snout, tip reaches to the 10th lateral scale. Inserted 2.4 times as far from the ventral as from the dorsal profile. Axillary scale large and pointed, 3.5 in head, 2.5 in pectoral.

Ventrals 1.6 in head, inserted below midway between origin of first dorsal and hind margin of head. Edge of fin subtruncate. Axillary scale 3.0 in head.

Caudal moderately forked, upper lobe longer, mid-rays 1.8 in head.

Scales cycloid or very feebly denticulate, or with scalloped edge, predorsal scales slightly longer than wide (Pl. XXI, A and B). No

secondary squamation. Lat. ser. 37-39, l.tr. 12-13, three cheek scales, 12 predorsal to above hind margin of head.

Colour.—Bright silvery, slightly dusky above. Sometimes a golden opercular spot. Traces of faint longitudinal stripes. Axillary spot very distinct.

Localities.—Isipingo lagoon, Durban Bay, Kosi Bay.

Length.—Up to 230 mm.

Four specimens, from 190 mm. up, examined.

This appears to be a well-defined, but comparatively scarce and localised species.

Previous descriptions do not agree very well. Günther (*loc. cit.*) specifically mentions the well-developed adipose eyelids, whereas Boulenger (*loc. cit.*) neither describes them nor shows them in his figure. Barnard (*loc. cit.*) possibly never saw a specimen, and may have been misled by Boulenger's work.

As has been indicated above, the adipose eyelids of *robustus* are abnormally thin, and tend to shrink with preservation, especially if the specimen is permitted to become even superficially dry. Even so, the eyelids are then so well marked as to merit special mention.

It would be strange to find any species as strictly localised as this would appear from its recorded area. Day (Fish. India, 1888, p. 356) described as *caeruleomaculatus* Lacep., a species, which, except for the absence of adipose eyelids, agrees exactly with the diagnosis of *robustus*. I have not seen the original description of *caeruleomaculatus*, but Günther's diagnosis (*loc. cit.*, p. 445) of that species, while rather brief, agrees with that of Weber and de Beaufort (Fish. Indo-Aust. Archip., 1922, vol. iv, p. 250), and fits quite well a specimen of this species (from India) which I have examined and which is quite distinct from *robustus*. It is not unlikely that Day may have examined preserved specimens with eyelids so shrunken as to have misled him. It is extremely likely that Day's specimens were actually conspecific with *robustus*, in which case this species extends from Africa through Mauritius to the Indo-Malayan area, which appears reasonable.

According to the Indian netters on the Natal coast, *robustus* is never very plentiful, but relatively large numbers appear on the coasts in May. Unfortunately, little reliance can be placed upon their identifications.

M. robustus is closely related to *cephalus* as well as to *seheli*. From the former it is distinguished by the extra anal ray, by the nature of the eyelids, by the shape of the mouth, and by the scaly median fins. From the latter by the much shorter pectorals, and by the presence

of eyelids, as well as in dimensional relationships. It could scarcely be confused with any other South African species.

Mugil strongylocephalus Rich.

(Plates XVI, A, and XVIII, A, B.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 425, and p. 428 (*longimanus*).

1888. Day, Fish. India, p. 349, pl. lxxiv, fig. 3 (*cunnesius*).

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 239 (*longimanus*).

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 302 (*cunnesius*).

1925. Fowler, Proc. Ac. Nat. Sci. Phil., vol. lxxvii, p. 208 (*longimanus*).

Depth 3·8, length of head 3·6 in length of body. Eye 3·7, snout 3·6, interorbital width 2·3–2·5, postorbital 1·8–2·0 in length of head. Adipose eyelids well developed, almost encircling pupil, posterior more prominent, almost reaching pupil, aperture in membrane elliptical. Nostrils $\frac{1}{4}$ of eye diameter apart, anterior midway between profile of snout tip and anterior margin of eye. Lower margin of preorbital slightly bent, scarcely notched. End of preorbital narrow, serrated, maxilla almost concealed. Angle of lower jaw 92–96°, outline of jaw angular, or very slightly rounded (adults). Symphysial knob double. Upper lip thin, width at apex of snout $\frac{1}{6}$ of eye. Very minute pointed teeth in a single row in upper jaw. Villiform teeth on pterygoids and possibly also on tongue. Traces of minute teeth on vomer. Palatines and lower jaw edentate; exposed area between rami of mandibles short and narrow.

D IV+I, 8. First dorsal inserted 1·0–1·06 times as far from the tip of the snout as from caudal base, 1·2–1·3 times as far from the tip of the mid-caudal rays as from tip of snout. First spine 1·8–2·1, base of first dorsal 1·9–2·2 in head. Distance from origin of first to origin of second dorsal 1·15–1·25 in head. First dorsal inserted above the 10th–12th, second above the 19th–20th lateral scale. Pointed sheath scale extends behind first dorsal 2·2–2·5 in head, 1·8–2·2 in distance from origin of first to origin of second dorsal, 4·0–4·6 in distance from origin of first dorsal to tip of snout. Second soft ray 1·6–1·8, base of second dorsal 2·7–2·9 in head. Last ray longer than penultimate, fin not much elevated anteriorly, edge concave. Soft dorsal at least partly scaly.

A III, 9, inserted in advance of second dorsal, below the 17th–18th

lateral scale. Second ray 1.6–1.8 in head; shape of fin similar to that of dorsal; scaly.

P 15–16, 1.06–1.25 in head, tip reaches to 11th–12th lateral scale, inserted 2.6–3 times as far from the ventral as from the dorsal profile. Axillary scale, bluntly rounded or pointed, 3–3.5 in head.

Ventrals 1.6–1.7 in head, inserted below 1.1–1.2 times as far from the origin of the first dorsal as from the hind margin of the head. Edge of fin gently rounded. Axillary scale 2.7–3.0 in head. Ventrals and pectorals scaly on basal half.

Caudal moderately forked, mid-rays 1.8 in head; scaly.

Scales cycloid; mucus canal long and narrow. Predorsal scales

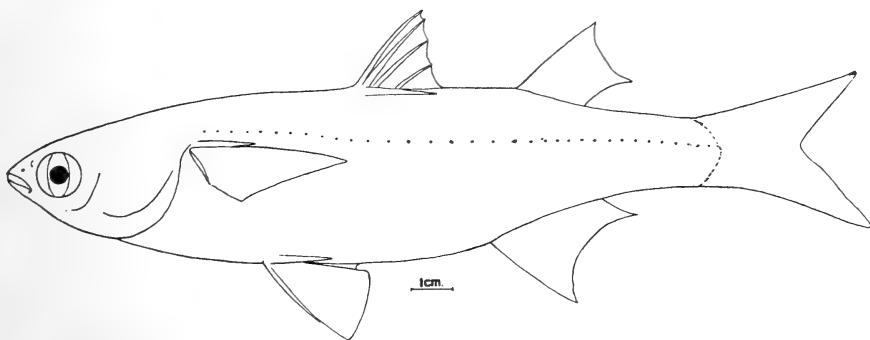


FIG. 5.—*Mugil strongylocephalus* Rich. (see note, fig. 3).

1.1 times as wide as long (Pl. XVIII, A and B). Lat. ser. 33–35, l.tr. 11–12, 3–4 cheek scales, 11–12 predorsal to above hind margin of head. A few small secondary elongated cycloid scales upon the scales of the nuchal region. (Also found in a specimen from India.)

Colour.—Silvery, slightly darker above. Caudal with dark margin. Pectoral axil black.

Localities.—Isipingo lagoon, Durban, Beira, Bay of Bengal.

Length.—Up to 195 mm.

Seven specimens, from 140 mm. in length up, examined.

I have not seen the original description, and the diagnosis of these specimens as *strongylocephalus*, being based on Günther's description (*loc. cit.*) of the type (and of others?), is provisional only.

There appears to be a somewhat hopeless confusion in regard to specimens described as *engeli* Blkr., *kelaartii* Gnthr., *longimanus* Gnthr., and *strongylocephalus*, the types of all of which come from the Indo-Pacific. I have seen only Günther's description of the latter species. The majority of authors agree in placing *kelaartii* in the synonymy

of *engeli*, but this appears to be doubtful. The former species was described from very young specimens, in which the pectorals are generally shorter than in the adult, and yet the pectorals of these juvenile types are stated to be actually longer than those of adult *engeli*. A critical revision of these two species would almost certainly establish that *kelaartii* is distinct from *engeli*.

M. kelaartii is held to be distinct from *longimanus* (*fide* Günther) mainly because the pectorals of the former are somewhat shorter. Here again the difference in size between the type-specimens would easily account for the slightly shorter pectorals of the former species, and the two are most probably conspecific. Further, the upper lip of *longimanus* is stated by Günther (*loc. cit.*) and by Weber and de Beaufort (*loc. cit.*) to be rather thick, whereas Day's figure (*loc. cit.*) shows a thin lip. The specimens described above have a thin lip, and, with the exception of the point of insertion of the first dorsal, agree exactly with Day's figure.

The head and chin of *strongylocephalus* as figured by Günther agree exactly with those of my specimens, and I can find nothing of importance in which they differ from Günther's description of that species. I have examined a specimen from the Bay of Bengal, kindly lent by the Indian Museum, Calcutta, labelled *cunnesius* C. and V., which agrees in all particulars with my specimens, and with Günther's description and figures of the head of *strongylocephalus*.

M. kelaartii and *longimanus* are held to differ from *strongylocephalus* in that the maxilla of the former two is entirely concealed, whereas the tip of that of the latter remains visible. Günther does not state the size of the type of the latter species, but it is, from what he says, presumably an adult. I have found that the extremity of the maxilla is generally more exposed in large specimens. In my specimens, especially in the smallest, when the mouth is pressed shut, it appears as if the maxilla is entirely hidden, but a careful examination reveals that the extremity always remains visible. This slight difference can alone scarcely justify the maintenance of *kelaartii* and *longimanus* as distinct from *strongylocephalus*, and in my opinion they are most likely conspecific. Fowler's Delagoa Bay specimen appears to be unquestionably conspecific.

This species, which appears to be widely distributed in the Indo-Pacific, will probably be found to be fairly common in Natal waters with more intensive collection.

It is easily distinguished by the well-developed eyelids, the long pectorals, and the scale-counts from all other South African species.

Mugil crenilabis Forsk.

? 1861. Günther, Cat. Fish. B.M., vol. iii, p. 458.

1888. Day, Fish. India, p. 355.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 307.

Depth 3·8–4·3, length of head 3·2–3·4 in length of body. Eye 3·8–4, snout 3·5, interorbital width 2·3–2·5, and postorbital length 1·9 in length of head. Adipose eyelids rudimentary. Nostrils $\frac{1}{4}$ eye diameter apart, anterior midway between front margin of eye and profile of snout tip. Lower margin of preorbital bent, deeply emarginate, end dilated, serrae large. Maxilla completely concealed.

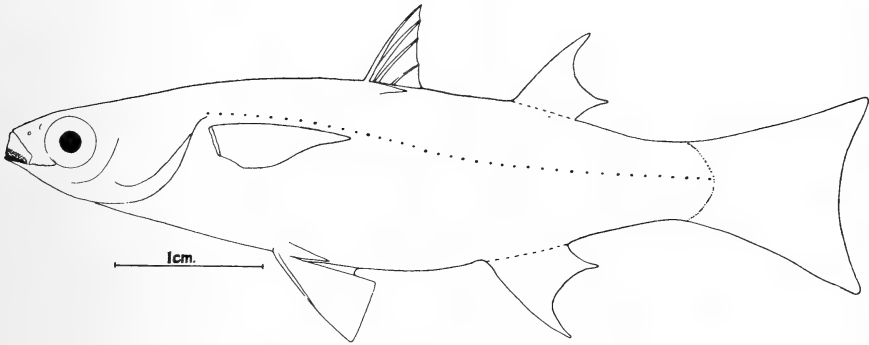


FIG. 6.—*Mugil crenilabis* Forsk. (see note, fig. 3).

Angle of mouth 94–96°, outline of jaw sub-angular. Upper lip thick, half, or slightly less than half, eye diameter at snout tip; lower margin with 5–6 series of fleshy tubercles, the lower with apical branches. Lower lip with expanded rugose plicate fringe. Exposed area on chin small and narrow. No teeth visible in jaws, or on palatal bones. Minute teeth on tongue.

D IV + I, 8. First dorsal inserted 1·0–1·06 times as far from snout tip as from caudal base, 1·3 times as far from the hind margin of the mid-caudal rays as from snout tip. First spine 2·1–2·3, base of first dorsal 4 in head. Distance from origin of first to origin of second dorsal 1·3–1·4 in head. First dorsal inserted above the 12th, second above the 24th lateral scale. Pointed sheath scale very short, extends behind origin of first dorsal 4·6 in head, 3·3 in distance from origin of first to origin of second dorsal, 8 in distance from origin of first dorsal to snout tip. Longest soft ray 1·8, base of second dorsal 3·5 in head. Second dorsal sub-falcate, edge concave; scaly.

A III, 9, inserted in advance of second dorsal, below the 23rd lateral scale. Longest ray 1.8 in head. In shape similar to dorsal.

P 16-17, 1.3-1.4 in head, tip reaches 12th lateral scale, inserted 2.5-3 times as far from the ventral as from the dorsal profile. No axillary scale, or a very indistinct short process.

Ventrals 1.7 in head, inserted below midway between hind margin of head and origin of first dorsal. Edge of fin truncate. Axillary scale 3.5-4 in head.

Caudal emarginate, lower lobe slightly longer, mid-rays 1.7 in head.

Scales cycloid, but with rudimentary scalloping on posterior margin, indicating that adults will probably have ctenoid scales. Predorsal scales about as wide as long. Lat. ser. 37-40, l.tr. 13-14, 3-4 cheek scales, 12-13 predorsally to above hind margin of head.

Colour.—(Preserved.) Uniform light brown.

Locality.—Durban.

Length.—Up to 56 mm.

Two specimens, 54 and 56 mm. in length, examined.

This is the only species from South Africa with tubercular lip, and it is easily distinguished from our others by this feature alone.

It is evidently fairly rare: I have seen none but the two S.A. Museum specimens described above. It has been stated to attain a length of over 200 mm., and to be fairly widely distributed in the Indo-Malayan area. I am not quite certain that our specimens are actually *crenilabis*, but they are very small and not too well preserved, so that I am unable to venture any definite opinion on the matter. The above description is taken as a composite from both specimens.

Probably *ruppellii* Gnthr. (*loc. cit.*, p. 458) is not different.

Mugil euronotus Smith.

(Plates XVI, E; XVII, E; XIX, G, H.)

? 1849. Smith, Illus. S.A. Pisces, pl. xxix, fig. 2.

1861. Günther, Cat. Fish. B.M., vol. iii, p. 443 (*saliens* part).

1861. Boulenger, F.W.F. Africa, vol. iv, p. 85 (*saliens* part).

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 307 (*saliens* part).

Depth 3.9-4.6, length of head 3.2 (J.)-4.5 (Ad.) in length of body. Eye 4.0 (J.)-4.8 (Ad.), snout 3.2 (Ad.)-3.7 (J.), interorbital width 2.2-2.6, and postorbital length 1.8-2.0 in length of head. Adipose eyelids rudimentary, better visible in adults. Nostrils $\frac{1}{8}$ of eye diameter apart, anterior nearer profile of snout tip than anterior

margin of eye. Lower margin of preorbital gently curved downwards, not notched, serrate. Maxilla not, or only extreme tip, exposed. Preorbital scaly. Angle of lower jaw $95-98^{\circ}$. Outline of jaw rounded or angular. Symphysial knob single. Upper lip fairly thick, width at apex of snout 3-3.5 in eye. Relatively large, close-set, flattened, recurved, dilated spatulate teeth with a notch at each side of apex (strangulated) (Pl. XVI, E) in a single series in upper jaw, similar in all stadia. Small cilia sometimes in lower jaw. Villiform teeth on vomer, palatines, pterygoids, and tongue. Exposed surface on chin long and narrow in juveniles, long and wide in adults.

D IV+I, 8. First dorsal inserted nearer caudal base than tip of snout, 1.04-1.07 times as far from the latter as from the former,

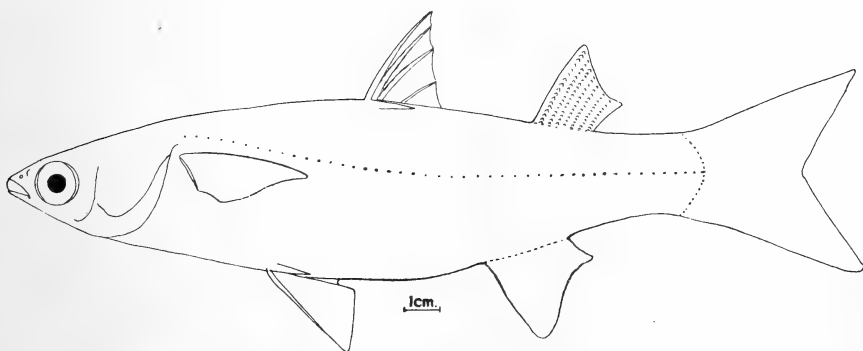


FIG. 7.—*Mugil euronotus* A. Smith (see note, fig. 3).

1.18-1.22 times as far from the hind margin of the mid-caudal rays as from the tip of the snout. First spine 1.7-1.9, base of first dorsal 2.4-2.7 in length of head. Distance from origin of first to origin of second dorsal 1.1-1.3 (Ad.) in head. First dorsal inserted above the 15th-17th, second above the 28th-30th lateral scale. Pointed sheath scale extends behind origin of first dorsal 3.5-4.0 in head, 6.5-8 in distance from tip of snout to origin of first dorsal, 2.9-3.5 in distance from origin of first to origin of second dorsal. Second soft ray 1.9-2.5, base of second dorsal 2.0-2.2 in head. Last ray slightly longer than penultimate, fin little elevated anteriorly, edge gently concave. Second dorsal completely scaly.

A III, 9, inserted in advance of second dorsal, below the 26th-27th lateral scale. Second ray 1.8-2.1 in head, last ray longer than penultimate, edge of fin slightly concave; scaly.

P 17, 1.4-1.5 in head, tip reaches to the 10th-12th lateral scale,

inserted 1.9–2.6 times as far from the ventral as from the dorsal profile. No axillary scale.

Ventrals 1.5–2.2 (J.) in head, inserted below midway between base of pectoral and origin of first dorsal, or nearer the latter. Edge of fin almost truncate. Axillary scale 4.3–5 in head.

Caudal moderately forked, upper lobe longer in adults; mid-rays 1.8–2.0 in head.

Scales predorsally cycloid, becoming ctenoid on sides and belly. Predorsal scales slightly wider than long (Pl. XIX, G and H), l.r. 43–45, l.tr. 14–15. Four cheek scales, 16–17 predorsal to above hind margin of head.

Colour variable. In sea, light dusky above, silvery below. In fresh or brackish water, almost black above, shading through dusky to light below.

Locality.—Knysna River, freshwaters of the Eastern Province, Port Alfred (river), Fish River, Buffalo River, Durban (harbour?), Sinkwazi River.

Length.—Up to 300 mm.

Seventeen specimens, from 55 mm. up, examined.

Plesiotypes, from Knysna, in the Albany Museum.

This has proved a very troublesome species. I was at first inclined to consider our specimens conspecific with *saliens* Risso, which is apparently so closely related to *capito* Cuv. that the majority of workers have found the greatest difficulty in differentiating at all clearly between them (see p. 616). Yet a careful examination of my specimens revealed so many striking differences from the latter species that I felt it was impossible for previous workers to have missed them.

I have sent a specimen to Mr. Norman of the British Museum, who has kindly compared it with their specimens of *saliens*. He has stated that theirs are rather small, but that the specimen I sent him is unquestionably different. He has also compared this with the various badly stuffed types of A. Smith, but is unwilling, in view of the condition of the latter, to give any opinion. I have examined specimens from Italy, among which were reputed *saliens*, but my specimens are unquestionably not conspecific.

In so far as I am able to judge from Smith's figure (*loc. cit.*) *euronotus* was probably identical with the present species. The first dorsal (in the figure) is inserted slightly behind midway between the base of the caudal and the tip of the snout, and the scale at the base of the first dorsal is shown to be about 8 in the distance from the origin of the first dorsal to the tip of the snout. Further, the maxilla is

drawn as if the tip would be hidden, or only just exposed, when the mouth is closed. The typical scaly second dorsal and the relatively large eye are not shown. Smith also mentions the presence of a row of "small criniform teeth in the upper jaw." Besides this, Smith's name possibly has reference to the markedly broad nuchal region,* which is characteristic. I am therefore provisionally reviving *euronotus*. This is preferable to instituting a new species, since *euronotus* is so numerous and widely distributed in our fresh and brackish waters that it is more than likely that A. Smith actually secured a specimen.

M. euronotus is very easily distinguished from all other South African species by many features, chief of which are the very short scaly process at the base of the first dorsal fin and the characteristic premaxillary teeth. These, with the scaly nature of the soft dorsal and the markedly larger eye, serve to distinguish this species immediately from *capito* in all stadia.

On our southern coasts, in my experience, *euronotus* rarely occurs in the sea. I have caught and identified well over a thousand specimens of *Mugil*, from the sea, from estuaries, and from fresh water. Only two specimens of this species have been found in the sea; in each case near the mouth of a tidal river, and in one case after a flood. In tidal estuaries *euronotus* is not usually found near the sea but high up the river, where the salinity of the water is low. Curiously enough, in Natal waters the species appears to be as commonly found in the sea itself.

In the Eastern Province *euronotus* occurs in most of the fresh waters, in most cases in isolated pools which have no connection with the sea. The species appears to thrive in dams, into which it has been introduced. It appears to breed freely in such waters, and many farmers ensure a regular supply of fresh fish by stocking dams or pools on their farms.

Mugil capito Cuv.

(Plates XVII, C; XIX, A-F.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 439.

1916. Boulenger, F.W.F. Africa, vol. iv, p. 83, fig. 49.

1918. Athanassoupoulos, Ann. Mus. Civ. Gen., vol. xlviii, p. 26.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 304.

* *euronotus* (=S. × S.E. wind) may, however, refer indirectly to the part of our area, i.e. the south and south-eastern coastal regions, in which this species occurs, although Smith states that it inhabits the seas of the eastern and western coasts. Smith may have meant *eurynotus*.

Depth 3·8–4·4, length of head 3·6–4·2 (J.) in length of body. Eye 4·7 (J.)–6·3 (Ad.), snout 3·2–3·6, interorbital width 2·2–2·7, and postorbital length 1·8–1·9 in length of head. Adipose eyelids rudimentary, scarcely visible in juveniles, better developed in adults, but never extending further than the outer rim of the iris. Nostrils $\frac{1}{8}$ of eye diameter apart, anterior midway between anterior border of eye and profile of snout tip. Lower margin of preorbital scarcely bent, sometimes with a very small notch, lower and hinder margins serrate, scaly. End of maxilla well exposed. Angle of lower jaw 93–103°, outline of jaw subangular in juveniles, more rounded in

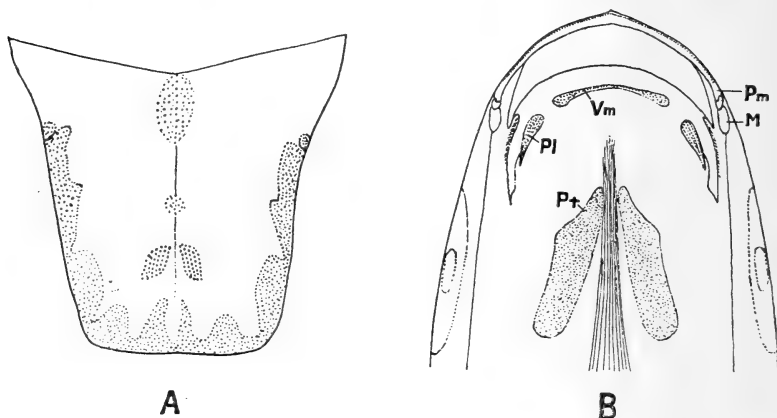


FIG. 8.—Diagram to show the dentition of *Mugil capito*. A, tongue; B, upper jaw and palate. M, maxilla; Pl, palatines; Pm, premaxilla; Pt, pterygoids; Vm, vomer. Dentate areas dotted.

adults. Symphyisial knob double. Upper lip fairly thin, width at snout apex 3·5 in eye. Slightly flattened, recurved, subspatulate teeth in a single fairly widely spaced row in the upper jaw (Pl. XVII, C). Lower jaw edentate. Villiform teeth on vomer, palatines, pterygoids, and tongue (fig. 8).

D IV + I, 8–9. First dorsal inserted nearer tip of snout than base of caudal, 1·06–1·1 times as far from the latter as from the former, 1·30–1·38 times as far from the hind margin of the mid-caudal rays as from the tip of the snout. First spine 1·7–2·0, base of first dorsal 2·1–2·5 in head. Distance from origin of first to origin of second dorsal 0·95–1·2 (J.) in head. First dorsal inserted above the 14th–16th, second above the 28th–30th lateral scale. Pointed sheath scale extends behind origin of first dorsal 2·3–2·6 in head, 2·0–2·6 in distance from origin of first to origin of second dorsal, 4–5 in distance from

origin of first dorsal to tip of snout. Longest soft ray 1.9–2.3, base of second dorsal 2.9–3.5 in head. Last ray slightly longer than penultimate, fin slightly elevated anteriorly, edge gently concave. Second dorsal scaly basally and anteriorly only.

A III, 9. Inserted slightly in advance of second dorsal, below the 26th–29th lateral scale. Longest ray 1.8–2.3 in head. In shape fin resembles dorsal. Scaly anteriorly and basally.

P 16–18, 1.45–1.75 in head (usually 1.6–1.7), tip reaches to the 10th–12th lateral scale. Fin scarcely ever as long as postorbital plus eye, inserted 1.5–2.3 times as far from the ventral as from the

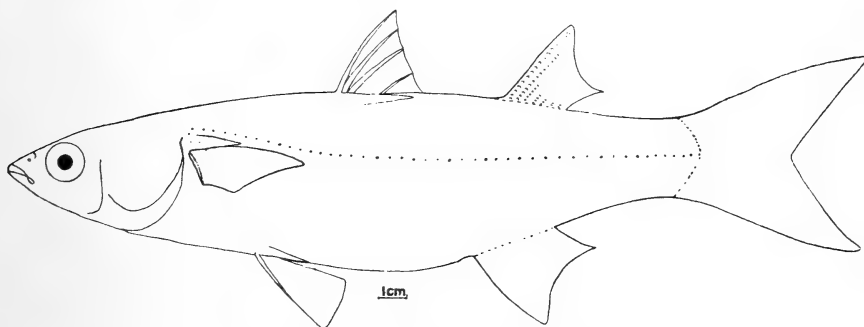


FIG. 9.—*Mugil capito* Cuv. (see note, fig. 3).

dorsal profile. Axillary scale 2.7 (Ad.)–4.5 in length of pectoral, obscure in young specimens.

Ventrals 1.6 (J.)–1.9 in head, inserted below midway between origin of first dorsal and hind margin of head, or slightly behind or before. Axillary scale 3.3–3.6 in head. Edge of fin truncate.

Caudal moderately forked, upper lobe slightly longer, mid-rays 2.1–2.5 in head.

Scales ctenoid (Pl. XIX, E and F), predorsal scales 1.0–1.2 (Ad.) times as long as wide. Mucus canal long and narrow. Very young fishes have cycloid dorsal scales, the denticulations develop with growth (Pl. XIX, A–E), l.r. 44–48, l.tr. 15–16; 4–5 cheek scales, 15–17 predorsal to above the hind margin of the head.

Colour.—Greenish to dull brown above, silvery below. Sometimes indistinct longitudinal streaks. Opercles usually with golden blotch.

Localities.—Walfisch Bay, Lambert's Bay, Table Bay, False Bay, Cape Agulhas, Port Beaufort, Knysna, Plettenberg Bay, Port Elizabeth, Port Alfred, Great Fish Point, East London, Mazeppa Bay, Durban, Sinkwazi. Also in tidal rivers.

Length.—Up to 405 mm.

Fifty-five specimens, from 50 mm. up, examined.

It appears to be reasonably certain that our specimens should be assigned to *capito* Cuv.

I have received a number of specimens from the Zoological Station, Naples, among which is one very likely conspecific with the species I have here designated *capito*. Specimens of *capito*, *auratus*, and *saliens* were included, but the preservative employed in the package had unfortunately destroyed all the labels, so that I am unable to say which specimen was actually identified in Naples as *capito*. I have also examined a specimen of reputed *capito* from Holland, but this is not conspecific; if it is correctly named, our species is not *capito*. This specimen has pectoral 1.35 in head and has no axillary pectoral process, and in general outlines resembles *auratus* Risso rather than *capito* or *saliens*.

Since, as is indicated below, I find it impossible from the literature to find any certain basis for the differentiation of *saliens* from *capito*, the most that can be said is that our specimens are probably identical with the latter species.

Boulenger identified a specimen (No. 12048) in the S.A. Museum as *capito* Cuv. He also identified as *saliens* Risso another specimen (No. 10157, from Table Bay), which I cannot by any means whatsoever differentiate from the former; the latter even possesses a well-developed scaly process in the pectoral axil, the absence of which in *saliens* Boulenger (*loc. cit.*) makes his Key characteristic for differentiation from *capito*.

Günther (*loc. cit.*) appears to have been satisfied that specimens from the Cape were identical with the European *capito*, but he remarked that Smith's specimens were badly stuffed, and of little use as types or for comparison—a fact which has recently been confirmed by a private communication from Mr. Norman of the British Museum.

If one may judge from the literature, a certain amount of mystery surrounds the identity of *saliens*. Günther (*loc. cit.*, p. 443) did not appear to be very certain of this species, and the features upon which he based his differentiation of *saliens* from *capito* (and from *auratus*) are inconstant and unreliable. Boulenger (F.W.F. Africa, *loc. cit.*) was obviously uncertain of *saliens*, and it may be remarked that this is the only African *Mugil* species of which he gives no figure. Barnard has evidently merely followed Boulenger in regard to the differentiation of *saliens* from *capito*.

Athanassopoulos (*loc. cit.*) has endeavoured to elucidate this,

but his conclusions have shed little light upon the problem, for he relies in his Key chiefly upon the supposed fact that the mouth of *saliens* is more convex than that of *capito*, which is at best of little practical value, and unlikely to be constant even were more precise details provided. This author has also proposed to use as diagnostic features certain dimensional relationships which would have to be tested over a wider range of stadia before their value can be accepted.

Differentiation between *capito* and *saliens*, based solely upon the presence or absence of the axillary process of the pectoral, has been accepted by many systematists, but does not appear to be absolute. Most authors state that this axillary process is present in *capito* but absent in *saliens*, whereas Athanassoupoulos says that the latter species actually has a short process in the axil. As far as the South African specimens are concerned, a large process is apparent only in adults of *capito*. Juveniles have a very short process in the axil, and in a long and regular series of all stadia it may be seen that the size and length of this process increases regularly with age. In preserved juvenile and half-grown specimens it is often exceedingly difficult to be certain whether the process is present or not, and so inconstant and unreliable is this feature that I should not venture to use it as a sole basis for differentiation in the present case.

Not only does it appear certain that *saliens*, as distinct from *capito*, does not occur in our area, but I have come, from the literature at my disposal, to doubt the validity of that species. At all events, it would appear that those who have specimens of *capito*, and of reputed *saliens*, must present stronger evidence for the maintenance of the latter species than has hitherto appeared. Athanassoupoulos states that the basal scale of the first dorsal of *saliens* is shorter than the base of this fin, whereas in *capito* it is slightly shorter to slightly longer than the base, but he has given no quantitative data. This may eventually prove to be the key feature of any established differentiation. Among the specimens from Naples are two which agree in some respects with the general diagnosis of *saliens*. There is no process, or a very small one, in the axil, and the preorbital is deeply notched; the mouth is more obtuse, and the scale at the base of the first dorsal is relatively longer than in *capito*, while the pectorals are 1.3-1.35 in head. I cannot venture to make any statement about the identity of these specimens, but they are certainly different from any species from South Africa which I have examined.

M. capito appears to be found throughout the greater part of our area, being most abundant on the West coast and round the Cape as far

as Port Beaufort, in which parts it is the most important *Mugil* species.

It is distinguished from other South African species by the scale-count, the very short pectorals, the scarcely obtuse mouth, and the well-exposed maxillary.

Mugil tricuspidens n. sp.

(Plates XVII, A, F, G; XVIII, G, H.)

1849. Smith, Illus. S.A. Pisces, pl. xxx, fig. 1 (*capensis* C. & V.).

1853. Pappe, Edible Fish. C.G.H., p. 27 (*multilineatus*).

1861. Günther, Cat. Fish. B.M., vol. iii, p. 443 (*saliens* part).

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 308 (*auratus* part).

Depth 4.0–4.5, length of head 4.0 (J.)–4.4 (Ad.) in length of body. Eye 4.6 (J.)–5.4 (Ad.), snout 3.4–3.7, interorbital width 2.0–2.5, post-orbital length 1.8–2.0 in length of head. Adipose eyelids rudimentary, scarcely visible in juveniles, clearly visible in adults, posterior better developed. Nostrils $\frac{1}{8}$ of eye diameter apart, anterior midway between front margin of eye and tip of snout profile. Lower margin of preorbital undulate, lower and hinder edge serrate. End of maxilla clearly visible. Angle of lower jaw 103–108°, outline of jaw rounded. Symphyseal knob indistinctly double. Upper lip thin, width at apex of snout 3–4 in eye. Flattened, apically dilated, recurved, tricuspid teeth (Pl. XVII, G) in a single series in upper jaw: in juveniles the teeth are more dilated, and the central cusp is spatulate (Pl. XVII, F). When viewed in fresh specimens, usually the central cusp only shows. The lip must be pushed back before the basal cusps are to be seen. The relatively large size of the teeth, and the wide spacing of the central cusps are distinctive characters. Lower jaw edentate. Villiform teeth on vomer, pterygoids, and tongue. Palatines edentate. In adults the membrane of the roof of the mouth, and of the tongue, have close-set, apically dilated, tricuspid cilia.

D IV + I, 8. First dorsal inserted 1.0 (J.)–1.07 times as far from base of caudal as from tip of snout, 1.25–1.35 times as far from hind margin of the mid-caudal rays as from tip of snout. First spine 1.9–2.1, base of first dorsal 2.1–2.5 in head. Distance from origin of first to origin of second dorsal 1.0–1.1 times head. First dorsal inserted above the 15th or 16th, second above the 28th or 29th lateral scale. Pointed sheath scale extends behind origin of first dorsal, 2.5–2.8 in head, 5.4–5.8 in distance from snout tip to origin

of first dorsal, 2.4–2.8 in distance from origin of first to origin of second dorsal. Second soft ray 1.5–1.8, base of second dorsal 2.6–2.8 in head. Last ray longer than penultimate, fin anteriorly elevated, sub-falcate, edge concave. Second dorsal scaly only anteriorly and basally.

A III, 9, inserted slightly in advance of second dorsal, below the 27th–28th lateral scale. Second ray 1.6–1.8 in head, last ray longer than penultimate; edge of fin concave; scaly.

P 18, 1.2–1.3 in head, tip reaches to the 11th or 12th lateral scale, inserted 1.6–2.0 times as far from the ventral as from the dorsal

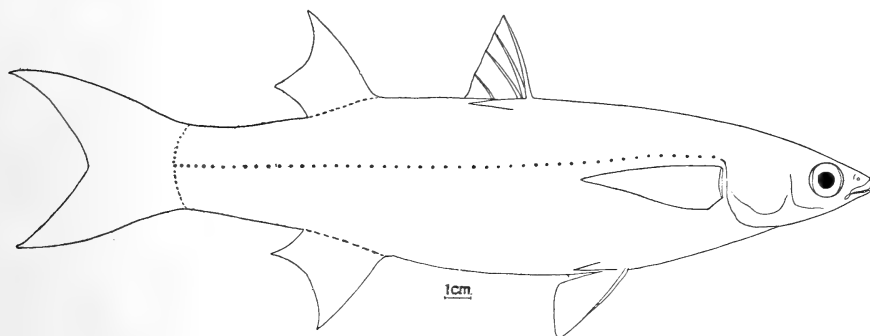


FIG. 10.—*Mugil tricuspidens* n. sp. (see note, fig. 3).

profile. No marked axillary scale in juveniles; a short, blunt, curved scale in adults, movable only in fresh specimens.

Ventrals 1.7–1.8 in head, inserted below midway between base of pectoral and origin of first dorsal, edge of fin gently rounded. Axillary scale 3.1–3.5 in head.

Caudal forked, upper lobe longer in adults, mid-rays 1.7–1.9 in head.

Scales ctenoid: mucus canal short, oblique. Predorsal scales nearly as wide as long (Pl. XVIII, G and H), l.r. 43–48, l.tr. 14–15. Four cheek scales, 16–17 predorsal to above hind margin of head.

Colour.—Greenish above, silvery on sides and below. 7–8 very distinct longitudinal dusky streaks corresponding with the scale rows, visible in all but the very youngest stadia. Opercles golden or bronzy.

Localities.—Mossel Bay, Knysna River, Zwartkops River, Buffalo River, Mazeppa Bay, Durban.

Length.—Up to 550 mm.

Sixteen specimens, from 60 mm. in length up, examined.

Types, from Knysna, in the Albany Museum.

There is very little doubt that the specimens described by Smith

(*loc. cit.*), as *capensis* C. and V., belong to this species. The sole diagnostic feature in the description is the scale-count, which is valid also for *capito* or *saliens*. The figure, however, leaves no doubt about the identity with *tricuspidens*.

It may be noted that in A. Smith's pl. xxx, fig. 1 is below and fig. 2 above. Pappe (*loc. cit.*) had evidently not noticed this, for he has obviously confused *multilineatus* with *capensis*.

Boulenger (*loc. cit.*), presumably having seen both the type of *capensis* C. and V. and Smith's specimen, stated that this latter is not *capensis* C. and V. Günther (*loc. cit.*) accepted Smith's diagnosis, but regarded the latter species as identical with *euronotus* Smith, and stated that both are identical with *saliens* Risso.

The original description of *capensis* (C. and V., Hist. Nat. Poiss., vol. xi, p. 108) is so vague and brief that it is quite impossible even to guess what species was actually described.

I am therefore provisionally naming this *tricuspidens* n. sp., and must leave the final pronouncement of the validity of this step to some worker who may be able to examine adequate material, including the type of *capensis* C. and V.

As this species is normally estuarine, it is possible that it may prove to be endemic.

It is well differentiated from our other species by numerous features, chiefly by the relatively large tricuspid teeth, while the characteristic longitudinal stripes show up well even in preserved specimens.

It may be noted that net fishermen at Knysna constantly distinguish this species as the "Streepharder," naming large specimens (unfortunately in common with large specimens of all species) "Springer."

M. tricuspidens does not appear to be anywhere very numerous nor specially gregarious, and, so far as I am aware, occurs only in tidal estuaries. Juvenile specimens are seldom encountered, and since the species is characterised by most extraordinary leaping powers, large numbers are rarely taken by the nets. I have at night in a boat frequently pursued adults of this species, which are exceedingly difficult to capture. When startled, large adults will leap anything up to 40 feet, rising 7 to 8 feet in the air, and the leap may be repeated six or seven times. The species may be clearly distinguished at night, when in the air, by means of a powerful light, the longitudinal stripes showing up clearly against the light silvery body.

Specimens occasionally jump into a boat which carries a light; large adults weighing $5\frac{1}{2}$ lb. have been taken in this manner, and I

have known a man to be knocked from his seat by the impact of one of these fishes on his chest.

At Knysna ripe females are encountered in the late autumn and early spring. Specimens are usually encountered at night in shallow water on mud-banks, and are exceedingly shy. I have occasionally been able to approach specimens which have continued to circle over the mud, clearly visible in the light of the lamp, but the least movement of the light, or any noise in the boat, results in the characteristic leap. On one occasion a dozen or more large specimens broke water round the boat, and for some seconds the air appeared to be full of silvery bodies, and the plunging leaps produced a considerable volume of sound.

Mugil seheli Forsk.

(Plates XVI, C, and XVIII, C, D.)

1888. Day, Fish. India, p. 355.

1916. Boulenger, F.W.F. Africa, vol. iv, p. 91, fig. 53.

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 252.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 306.

Depth 3.8, length of head 3.8 in length of body. Eye 4.5, snout 4.2, interorbital width 2.4, and postorbital length 1.8 in length of head. Adipose eyelids rudimentary. Nostrils $\frac{1}{4}$ of eye diameter apart, anterior nearer the profile of the tip of the snout than the anterior margin of the eye. Lower margin of preorbital bent, notched, and serrate; scaly. Maxilla completely concealed. Angle of lower jaw 103° , outline of jaw angular. Upper lip thin, width at apex of snout 4 in eye. Symphysial knob double. No teeth in jaws visible. Vomer with traces of fine teeth, tongue with patches of villiform teeth. Palatines edentate. Exposed area on chin very short and narrow, would probably increase with age.

D IV + I, 8. First dorsal inserted 1.1 times as far from caudal base as from the tip of the snout, 1.4 times as far from the tip of the mid-caudal rays as from the tip of the snout. First spine 2.1, base of first dorsal 2.9 in head. Distance from origin of first to origin of second dorsal 1.05 in head. First dorsal inserted above the 13th, second above the 26th lateral scale. Pointed sheath scale extends behind origin of first dorsal 2.4 in head, 2.1 in distance from origin of first to origin of second dorsal, and 4.2-5 in distance from origin of first dorsal to tip of snout. Longest soft ray shorter than the ventral fin and than the distance from hind margin of head to the

centre of the eye, 1.8; base of second dorsal 2.7 in head. Last ray longer than penultimate, fin scarcely falcate anteriorly, edge moderately concave. Soft dorsal scaly.

A III, 9. Inserted slightly in advance of second dorsal, below the 25th lateral scale. Longest ray 1.7 in head, shape of fin similar to that of second dorsal; scaly.

P 18, 1.1 in head, tip reaches to the 13th lateral scale, fin inserted 3.3 times as far from the ventral as from the dorsal profile. Axillary scale long and pointed, 3.2 in length of head. Most of fin scaled.

Ventrals 1.6 in head, longer than longest dorsal ray, inserted below

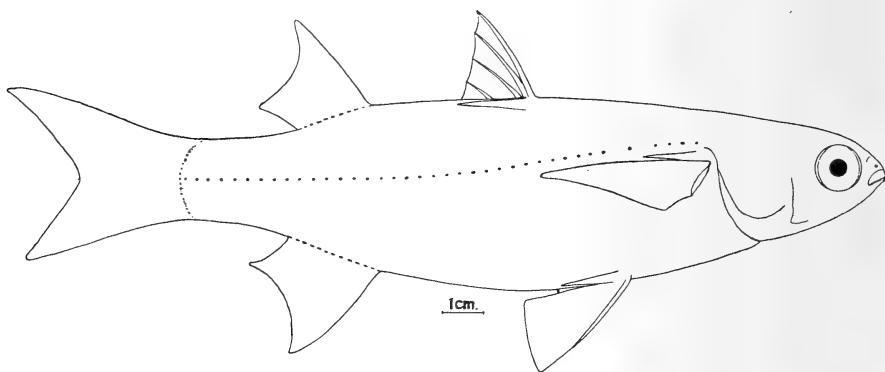


FIG. 11.—*Mugil seheli* Forsk. (see note, fig. 3).

midway between hind margin of head and origin of first dorsal or slightly nearer the former. Edge of fin gently rounded. Axillary scale 3 in head. Fin almost completely scaly.

Caudal deeply forked, upper lobe longer, mid-rays 1.7 in head; scaly.

Scales more or less cycloid, traces of denticulations on exposed area. Mucus canal long and narrow (Pl. XVIII, C and D). Predorsal scales as wide as long. Lat. ser. 39–41, l.tr. 14, 3 cheek scales, 14 predorsally to above the hind margin of the head.

Colour.—Silvery, darker above. Axil of pectoral black.

Locality.—Durban, Chilka Lake, Bay of Bengal.*

Length.—Up to 170 mm.

Three specimens, from 167 mm. in length up, examined.

Judging from the literature many authors are uncertain of the diagnosis of *seheli*. The majority agree in a scale-count of 38–42 and in stating that the maxillary is hidden. Fowler (Proc. Ac. Nat. Sci. Phil., 1925, vol. lxxvii, p. 209) describes as *seheli* two specimens

* A specimen kindly lent by the Director of the Indian Museum, Calcutta.

from Delagoa Bay, and states that the scales are 33-35, but omits to mention whether the maxillary is hidden or exposed. These specimens can hardly be *seheli*; the description agrees closely with that of *strongylocephalus* Gnthr., and it is possible that Fowler may have overlooked the adipose eyelids, although in the same paper he describes a specimen of this latter species (as *longimanus* Gnthr.) from the same locality. (But see note under *canaliculatus*.)

M. caeruleomaculatus Lac. is by many authors held to be a synonym of *seheli*. I have, however, examined a specimen of the former species from India,* and it is quite clearly distinct.

M. seheli is not very abundant in our area, nor does it appear to extend south of Natal. It is apparently widely distributed in the Indo-Pacific.

Mugil buchanani Blkr.

(Plates XVI, D, and XX, C, D.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 446 (*ceylonensis*).

1888. Day, Fish. India, p. 358.

1916. Boulenger, F.W.F. Africa, p. 93, fig. 55 (*ceylonensis*).

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 305 (*ceylonensis*).

1928. Fowler, Fish. Oceania, p. 123.

Snout very broad and short, bluntly rounded anteriorly. Depth 3.3-3.7, length of head 3.3 (J.)-4.0 (Ad.) in length of body. Eye 3.2 (J.)-5 (Ad.), snout 3.5 (J.)-4.0 (Ad.), interorbital width 2.0-2.3 (J.), and postorbital length 1.7-1.9 in length of head. Adipose eyelids rudimentary, better visible in adults. Nostrils $\frac{1}{3}$ of eye diameter apart, anterior as far from profile of snout tip as posterior from anterior margin of orbit. Lower margin of preorbital slightly bent, not, or slightly, notched; end truncated, lower and hinder edge serrated, scaly. End of maxilla completely concealed. Angle of lower jaw 110-122°, outline of jaw almost angular. Symphyseal knob double. Upper lip thin, width at apex of snout 5 in eye. Very minute ciliiform teeth in a single series in each jaw in very young specimens, none visible in half-grown or adults. Vomer and palatines edentate. Pre-vomerine groove distinct. Villiform teeth on pterygoids and round the anterior margin of the tongue. Space between rami of mandibles on chin almost absent in juveniles, gradually enlarges with age; long and wide in large adults.

D IV+I, 8. First dorsal inserted 0.90 (J.)-1.15 (Ad.) times as

* Kindly lent by the Director of the Indian Museum, Calcutta.

far from the caudal base as from tip of snout, 1.23 (J.)–1.43 times as far from the hind margin of the mid-caudal rays as from the tip of the snout. First spine 1.7–1.9, base of first dorsal 2.0–2.2 in head. Distance from origin of first to origin of second dorsal 1.0–1.2 (J.) in head. First dorsal inserted above the 9th–12th, second above the 20th–23rd lateral scale. Pointed sheath scale extends behind the origin of the first dorsal 2.6–2.9 (J.) in head, 2.4–2.6 in distance from origin of first to origin of second dorsal and 5.0–6.6 in distance from origin of first dorsal to tip of snout. Second soft ray longer than ventrals, and than distance from hind margin of head to centre of eye, 1.25–1.4 (J.); base of second dorsal 2.6–3 (J.) in head. Last ray

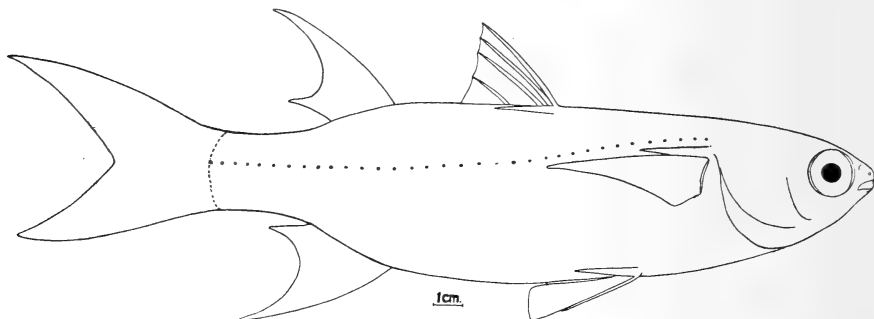


FIG. 12.—*Mugil buehanani* Blkr. (see note, fig. 3).

longer than penultimate; in adults the fin is anteriorly elevated, falcate, edge deeply concave. Second dorsal densely scaled.

A III, 9. Inserted opposite origin of second dorsal. Second ray 1.2–1.4 (J.) in head, last ray longer than penultimate; in adults the fin is anteriorly elevated, falcate, edge deeply concave, densely scaled.

There is considerable alteration in the shape of the soft dorsal and anal fins with growth. In very young specimens (< 100 mm.) the anterior rays are fairly long, but the fin is not markedly falcate, since the middle rays are relatively longer than in the adult, and the edges of the fins are feebly concave. As the size of the fish increases, the anterior rays become relatively longer and the middle rays shorter, the fin assuming the anteriorly falcate shape when the length of the fish is more than ± 120 mm. The scaling of the fins also increases from the very young to this size. In the former the basal scaling only is plain, there being apparently a mere sprinkling of light scales over the distal portions of the fins.

P 17–18, 1.0–1.15 (J.) in head, tip reaches 11th–12th lateral scale,

inserted 2·8–3·3 times as far from ventral as from dorsal profile. A large scaly axillary process, 2·8–5·2 (J.) in length of head.

Ventrals 1·5–1·7 in head, inserted below midway between hind margin of head and origin of first dorsal, or nearer the latter; edge of fin truncate. Axillary scale 2·8–3·4 in head.

Caudal deeply forked, upper lobe longer, mid-rays 1·7 (J.)–2·0 in head, densely scaled.

Ventrals and pectorals scaly basally.

Scales cycloid, ventral scales very finely denticulate. Longitudinal length of predorsal scales 1·1 times width (Pl. XX, C and D), l.r. 33–36, l.tr. 13; 9–11 predorsal to above hind margin of head, 3–4 cheek scales.

Colour.—Bright silvery, darker above. Indistinct longitudinal stripes. Axil of pectoral black, except in very small specimens.

Localities.—Knysna, Durban, Chinde, Celebes.*

Length.—Up to 385 mm.

Eleven specimens, from 68 mm. up, examined.

It appears to be fairly certain that *ceylonensis* Gnthr. is a synonym of *buchanani* Blkr. This was Day's opinion (*loc. cit.*) after examining the types of both species, with which Fowler (*loc. cit.*) is apparently in agreement.

This species has, beyond the early juvenile stages, a characteristic shape, which distinguishes it at a glance from all other South African species; *buchanani* and *compressus* are the only two species with markedly falcate dorsal and anal fins. *M. buchanani* is easily distinguished from the latter by the very blunt rounded snout, by the shape and length of the ventrals, and by the concealed maxilla.

It is probably widely distributed in the Indo-Pacific area. From the outlines this is a swift pelagic species.

Probably many specimens now assigned to *caeruleomaculatus* Lac. will be found to be conspecific with *buchanani* (see notes under *robustus*).

Mugil compressus Gnthr.

(Plates XVII, B, and XX, E, F.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 451.

1911. Gilchrist and Thompson, Ann. S.A. Mus., vol. xi, p. 42 (*diadema*).

1916. Boulenger, F.W.F. Africa, vol. iv, p. 94 (*macrolepis* part).

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 309 (*diadema*).

* A specimen, 107 mm. in length, kindly lent by Dr. de Beaufort, Curator of the Zool. Museum, Amsterdam.

Depth 4.0-4.3, length of head 4.0-4.4 in length of body. Eye 5.1-6, snout 3-3.4, interorbital width 2.0-2.2, length of postorbital part of head 1.7-1.8 in length of head. Adipose eyelids rudimentary, visible in adults. Nostrils $\frac{1}{3}$ of eye diameter apart, anterior slightly behind midway between anterior margin of orbit and profile of snout tip. Lower margin of preorbital curved, not, or very slightly, notched; serrate, scaly. End of preorbital obliquely truncated, edge slightly convex. End of maxilla clearly visible. Angle of lower jaw 105° , outline of jaw angular. Symphysial knob double. Upper lip thin, width at apex of snout 3 in eye. Very small recurved slightly compressed teeth in two series in upper jaw, the posterior series well back. Lower jaw edentate. Villiform teeth on pterygoids, and in patches round the anterior margin of the tongue. Vomer and palatines edentate. Exposed space between the rami of the mandibles long and narrow.

D IV + I, 8. First dorsal inserted 0.95-1.05 times as far from tip of snout as from caudal base, 1.25 times as far from the hind margin of the mid-caudal rays as from the tip of snout. First spine 1.6-1.7, base of first dorsal 2.1-2.2 in head. Distance from origin of first to origin of second dorsal 0.9-1.2 times head. First dorsal inserted above the 10th-11th, second above the 20th-22nd lateral scale. Pointed sheath scale extends behind origin of first dorsal 2.8-3.3 in head, 6-6.8 in distance from origin of first dorsal to snout tip, 3.2-3.5 in distance from origin of first to origin of second dorsal. Highest soft ray longer than distance from hind margin of head to centre of eye, 1.2-1.3; base of second dorsal 2.6-2.9 in head. Last ray longer than penultimate, fin anteriorly elevated, falcate, edge deeply concave. Second dorsal densely scaled. First ray much longer than distance from hind margin of head to centre of eye.

A III, 9. Inserted slightly in advance of second dorsal, below the 19th-21st lateral scale. Second ray 1.1 in head, last ray longer than penultimate, fin anteriorly elevated, falcate, deeply concave. Densely scaled.

P 16, 1.2 in head, tip reaches 8th-9th lateral scale, inserted 2.6-3 times as far from the ventral as from the dorsal profile. No axillary scale.

Ventrals 1.25 in head, longer than head without snout, inserted below 1.3-1.4 times as far from first dorsal origin as from hind margin of head. First and second rays elongate, fin sub-falcate. Axillary scale 3.8 in head.

Caudal deeply forked, upper lobe longer, mid-rays 1.6-1.7 in head

Scales large, predorsal very finely denticulate, ventral scales more distinctly so. Predorsal scales as wide as long (Pl. XX, E and F), l.r. 29-32 (Günther 28), l.tr. 11, 10-11 predorsal to above hind margin of head. Five cheek scales.

Colour (Preserved).—Uniform light brown; silvery in life. Hind edge of scales dark.

Localities.—Port Elizabeth, Durban, St. Lucia Bay, Kosi Bay.

Length.—Up to 600 mm.

Five specimens, all adults (one stuffed, Port Elizabeth Museum), examined.

It has earlier been indicated that the majority of Günther's descriptions of *Mugil* species (*loc. cit.*, pp. 417-460) are scarcely full enough

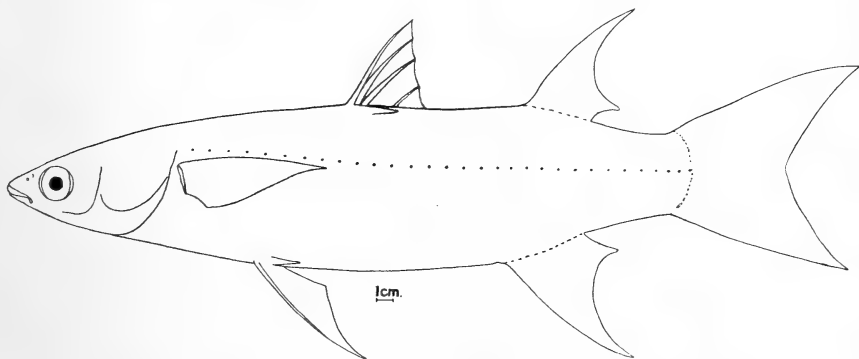


FIG. 13.—*Mugil compressus* Gnthr. (see note, fig. 3).

to be of much diagnostic value. But that of the Australian species, *compressus* Gnthr., is an exception. I have very little hesitation in pronouncing *diadema* G. and T. synonymous. Nevertheless, as I have seen no Australian specimens, this diagnosis is provisional only.

It must be confessed that I was led to search for some Indo-Pacific form, with which *diadema* might prove identical, by the outlines of this species, which indicate a swift, pelagic fish, possessing great leaping powers; likely to be widely distributed, but difficult to capture.

In certain minor details only does the diagnosis of *compressus* differ from that of *diadema*. Günther states that the former has 28 series of scales: *diadema* has 29-32; this is well within normal limits of variation. The exposed surface on the chin of *compressus* is stated to be very short and narrow, in *diadema* it is long and narrow. I have found that the extent of this exposed area varies in one species, and increases with age. Long preservation in spirits

might account for the highly compressed body of Günther's specimen, a feature he regards as significant, but which I have observed in old spirit-preserved specimens of all species. In no significant feature does *compressus* differ from *diadema*.

The outstanding characteristics which, with the small number and large size of the scales, immediately distinguish *compressus* from all other species are the very elongate ventrals, longer than the head without the snout, inserted much nearer to the hind margin of the head than to the origin of the first dorsal (see note under ventral fins, p. 595).

Fowler (Fishes Oceania, Mem. B.P. Bishop Mus., 1928, vol. x, p. 125) considered *compressus* identical with *macrolepis*. Boulenger (*loc. cit.*) originally considered *diadema* synonymous with *macrolepis*, but later recognised (*fide* Barnard, *loc. cit.*) the former as distinct. Fowler has evidently missed the significant paragraph about the ventrals in the original description of *compressus*. In 1926 Fowler (Proc. Ac. Nat. Sci. Phil., vol. lxxvii, p. 210) suggested that *diadema* is a synonym of *oligolepis* Blkr., which is not likely. It is scarcely possible that Fowler's specimen is a juvenile *compressus*, since he stated that the pectoral was 1.6 and the ventral 1.4 in head, neither of which agrees with this species.

It may be remarked that the elongate anterior dorsal, anal, and ventral rays are probably marked only in advance of the early juvenile stages. I have seen no young specimens, but these will probably prove difficult to distinguish from similar stadia of *macrolepis*. The relative length of the scale at the base of the first dorsal will probably be of use in distinguishing juveniles.

Mugil macrolepis Smith.

(Plate XX, A, B.)

1849. Smith, Illus. S.A. Pisces, pl. xxviii, fig. 2.

1861. Günther, Cat. Fish. B.M., vol. iii, p. 447 (*smithii*).

1916. Boulenger, F.W.F. Africa, vol. iv, p. 94, fig. 56.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 309 (pl. xii, fig. 2, *non macrolepis*).

Body of characteristic shape, usually with a false appearance of extra width between the anal and the soft dorsal fins.

Depth 3.6–3.8, length of head 3.8 in length of body. Eye 4.1–4.3, snout 3.5–4, interorbital 2.2, postorbital length 1.9–2 in length of head. Adipose eyelids rudimentary but clearly visible in adults.

Nostrils $\frac{1}{2}$ of eye diameter apart, anterior midway between anterior margin of eye and profile of snout tip. Lower margin of preorbital bent downwards; not, or scarcely, notched; lower and hinder edge serrate. End of maxilla exposed. Angle of lower jaw $105-108^\circ$, outline of jaw gently rounded, symphysial knob single. Upper lip thin, width at snout apex 5 in eye. Very small, slightly spatulate teeth, with a notch at each side of apex, in two rows in upper jaw; teeth fairly close-set in each row, the hinder row well behind the anterior. Villiform teeth on vomer, pterygoids, and anterior margin of tongue. Lower jaw and palatines edentate. Groove before vomer distinct. Exposed area on chin fairly short and narrow.

D IV + I, 8. First dorsal inserted 1.04–1.08 times as far from the

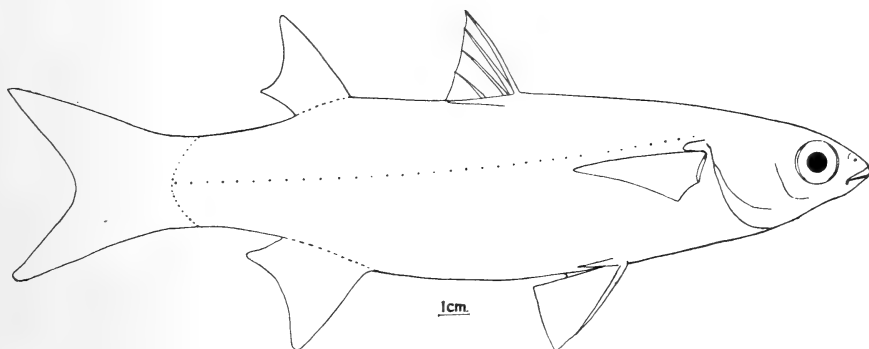


FIG. 14.—*Mugil macrolepis* A. Smith (see note, fig. 3).

tip of the snout as from caudal base, 1.15–1.25 times as far from the hind margin of the mid-caudal rays as from tip of snout. First spine 1.7, base of first dorsal 1.9–2.1 in head. Distance from origin of first to origin of second dorsal 1.0–1.1 in head. First dorsal inserted above 13th–14th, second above the 24th–25th lateral scale. Pointed sheath scale extends behind origin of first dorsal 2.5 in head, 5–5.8 in distance from snout tip to origin of first dorsal, 2.3–2.5 in distance between origin of first and origin of second dorsal. Second soft ray shorter than hind margin of head to centre of eye, 1.7, base of second dorsal 3.1 in head. Last ray longer than penultimate, fin little elevated anteriorly, edge gently concave. Second dorsal completely scaly in adults.

A III, 9, inserted slightly in advance of second dorsal, below the 23rd lateral scale. Second ray 1.7 in head, last ray longer than penultimate, in shape resembles second dorsal. Completely scaled.

P 16, 1.25–1.35 in head, tip reaches to the 10th–11th lateral scale, inserted twice as far from the ventral as from the dorsal profile. No axillary scale, or a very short blunt one, in adults.

Ventrals 1.5 in head, shorter than head without snout, inserted below 1.0–1.2 times nearer hind margin of head than origin of first dorsal. First ray very slightly longer than remainder, edge of fin almost straight. Axillary scale 3–3.5 in head.

Caudal slightly forked, mid-rays 1.8–1.9 in head.

Scales finely ctenoid; predorsal scales about 1.2 times as long as wide. Mucus canal long and narrow (Pl. XX, A and B), l.r. 33–35, l.tr. 12; 3 cheek scales, 12 predorsal to above hind margin of head.

Colour.—Bright silvery, slightly darker above.

Locality.—Mazeppa Bay, Durban, Isipingo River, Sinkwazi Lagoon, Kosi Bay.

Length.—Up to 305 mm.

Thirty-four specimens, 66 mm. in length up, examined.

There seems to be little doubt about the identity of the specimens described above.

This is a very characteristic species. It is easily distinguished from all others from South Africa by the number of scales, by the absence of the long scaly process from the axil of the short pectoral, and by the exposed maxillary.

Boulenger (*loc. cit.*) considered *trosceli* Blkr. a synonym of *macrolepis*, while Fowler (Fishes Oceania, Mem. B.P. Bishop Mus., 1928, vol. x, p. 124) placed both *trosceli* and *borneensis* in the synonymy of *macrolepis*. On the other hand, Weber and de Beaufort (Fish. Indo-Aust. Archip., 1922, vol. iv, pp. 248, 249) considered *trosceli* and *borneensis* distinct from one another, and (evidently, since they made no mention of it) also from *macrolepis*. A careful analysis of the various descriptions appears to support Fowler's conclusion. If this is correct, then *macrolepis* is widely distributed in the Indo-Pacific. Probably *olivaceus* Day (Fish. India, p. 357) is not different.

M. macrolepis appears to be fairly abundant on the Natal coast.

Mugil canaliculatus n.sp.

(Plates XVI, B; XVII, D; XVIII, E, F.)

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 303 (*speigleri*); p. 308 (*auratus*, part).

Depth 3.9–4.3, length of head 4.0 (J.)–4.5 in length of body. Eye 4.0 (J.)–4.6, snout 3–3.9, interorbital width 2.3–2.5, and postorbital

length 1.5–2.0 in length of head. Adipose eyelids visible even in juveniles, clearly visible in adults, posterior better developed than anterior, covering almost half of iris posteriorly. Nostrils $\frac{1}{6}$ of eye diameter apart, anterior nearer tip of snout profile than front margin of eye. Preorbital deeply notched and bent downwards, end dilated and rounded, lower and hinder edges serrate. End of maxilla well exposed. Angle of lower jaw 108–112°, outline of jaw angular. Symphyseal knob double. Upper lip thin, width at apex of snout 3–4 in eye. Very fine recurved, compressed, apically truncated teeth (Pl. XVII, D) in a single series in upper jaw; juvenile and adult teeth identical. Lower jaw edentate. Villiform teeth on vomer, palatines, pterygoids, and tongue. Exposed area on chin fairly long.

D IV + I, 8. First dorsal inserted 1.0–1.05 times as far from caudal base as from tip of snout, 1.25–1.3 times as far from the hind margin of the mid-caudal rays as from the tip of the snout. First spine 1.8–2.1, base of first dorsal 2.4–2.8 in head. Distance from origin of first to origin of second dorsal 0.95–1.1 times head. First dorsal inserted above the 13th–14th, second above the 24th–25th lateral scale. Pointed sheath scale extends behind the origin of the first dorsal 2.0–2.4 in head, 2.0–2.4 in distance from origin of first to origin of second dorsal, 4.3–4.9 in distance from origin of first dorsal to tip of snout. Second soft ray 1.6–1.7, base of second dorsal 2.2–2.6 in head. Last ray longer than penultimate, fin anteriorly very slightly elevated, edge gently concave. Second dorsal scaly only anteriorly and basally.

A III, 9. Inserted only slightly in advance of second dorsal, below the 23rd–25th lateral scale. Longest ray 1.7–1.8 in head, fin not much elevated anteriorly; scaly.

P 16, 0.95–1.15 (J.) in head, tip reaches to the 10th lateral scale, inserted 1.9–2.7 times as far from the ventral as from the dorsal profile. No axillary scale in juveniles, a very small obscure curved scale in adults.

Ventrals 1.5–1.6 in head, inserted below 1.1–1.3 times further from the hind margin of the head than from the origin of the first dorsal. Edge of fin almost truncate. Axillary scale 2.8–3.0 in head.

Caudal moderately forked, upper lobe longer in adults, mid-rays 1.7–1.9 in head.

Scales, dorsal weakly, ventral strongly, ctenoid. Predorsal scales slightly longer than wide, multicanalicate to about the third row down (Pl. XVIII, E and F). Canalisation appears to increase with

age, young fishes having 2-3, large adults up to 14 wavy canals on one scale. Lat. rows 36-39, l.tr. 13-14, 3-4 cheek scales, 13-14 predorsal to above the hind margin of the head.

Colour.—Dusky above, silvery below. Opercles dull.

Localities.—Knysna, Plettenberg Bay, Port Alfred, Great Fish Point, East London, Mazeppa Bay, Durban, Delagoa Bay. Also in tidal rivers.

Length.—Up to 285 mm.

Forty-three specimens, from 90 mm. up, examined.

Types, from Knysna, in the Albany Museum.

It is probable that this species must previously have been described, but I cannot yet with certainty assign it to any known species.

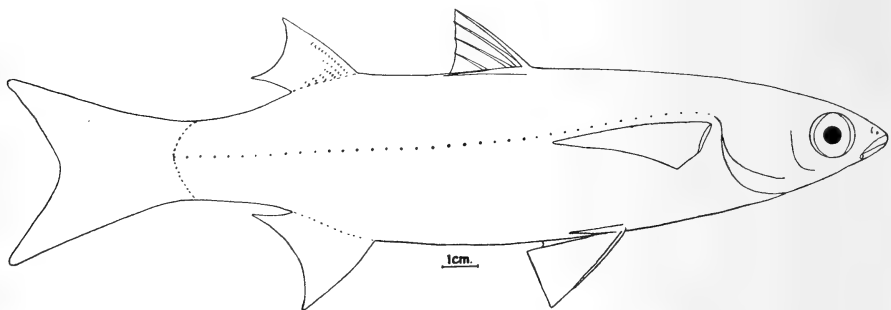


FIG. 15.—*Mugil canaliculatus* n. sp. (see note, fig. 3).

canaliculatus is very close to, if not actually identical with, *hoeferi* Stndnr., from Senegambia. Beyond the absence of the adipose eyelids in this latter species, there appears to be little difference between them. I have unfortunately been unable to obtain one of Steindachner's types for comparison, but Dr. Pietschmann of Vienna has kindly sent me an accurate drawing of one of the few remaining predorsal scales on the only scaled type of *hoeferi*, and this scale resembles those of *canaliculatus* in being multicanaliculate. Nevertheless, as I have not seen any of these West African types, and in view of the widely separated recorded areas of these species, it would appear better to maintain both for the present.

It is most likely that *canaliculatus* occurs in the Indo-Pacific, but I have not been able to recognise it from the descriptions of any species from this area. Barnard (*loc. cit.*) had identified one of the S.A. Museum specimens as *speigleri* Blkr., and others as *auratus* Risso. I have examined a specimen of *speigleri* from India, and *canaliculatus* is quite definitely distinct. I have also examined

specimens from Italy, among which were reputed *auratus*, and *canaliculatus*, while related, is certainly different. The latter has fewer scales, longer pectorals, and better developed adipose eyelids than the northern species.

It is probable that it is *canaliculatus* which Boulenger (F.W.F. Africa, p. 88) identified as *auratus* (from East London). Boulenger's figure of *auratus* (*loc. cit.*, fig. 50) might well pass for the former species. If the marked adipose eyelids and the scale-counts are overlooked, it would evidently be easy to confuse these two species, although I have forwarded a specimen to Mr. Norman of the British Museum, and he states that it is quite distinct from their specimens of *auratus*.

Fowler (Proc. Ac. Nat. Sci. Phil., 1925, p. 209) has described two specimens from Delagoa Bay as *seheli* Forsk., which cannot be that species, and are possibly *canaliculatus*.

M. canaliculatus is exceedingly abundant on the South and East coasts, at least as far as Delagoa Bay. It enters tidal rivers, but does not appear to ascend very far. At Knysna it may be seen that *canaliculatus* abounds up to about five miles from the mouth of the river; in the higher part of this area *tricuspidens* is also found, together with *cephalus*. Both of these latter species extend several miles farther up the river to the point where the water is only slightly saline. Beyond this stage, *cephalus* and *euronotus* are found.

M. canaliculatus does not appear to attain a large size. It is apparently only those species which are largely fluviatile, such as *cephalus* and *tricuspidens*, which grow very large.

At Knysna and Great Fish Point, ripe females of *canaliculatus* are observed during August and September.

M. canaliculatus does not apparently possess any marked leaping powers. This may have some connection with the markedly posterior insertion of the ventrals.

The canalisation of the scales, and the long pectorals, immediately distinguish this from all other South African species.

Mugil waigiensis, Q. and G.

(Plate XX, G, H.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 435.

1888. Day, Fish. India, p. 359, pl. lxxiii, fig. 4.

1916. Boulenger, F.W.F. Africa, vol. iv, p. 97, fig. 59.

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 244.

1925. Barnard, Ann. S.A. Mus., vol. xxi, p. 310.

? 1928. Fowler, Fishes Oceania, p. 124, fig. 27.

Dorsal profile flat, interorbital flat, head very depressed at occiput. Depth 4, length of head 3.1–3.3 in length of body. Eye 3.8–4.1, snout 3.0–3.6, interorbital width 2.1–2.2, and length of postorbital 1.9–2.1 in length of head. Adipose eyelids rudimentary. Nostrils 3.5 in eye diameter apart, anterior midway between profile of snout tip and anterior margin of eye. Lower margin of preorbital bent, not, or slightly, notched, serrated. End of maxilla exposed. Angle of mouth 95–97°, outline of lower jaw angular. Symphysial knob

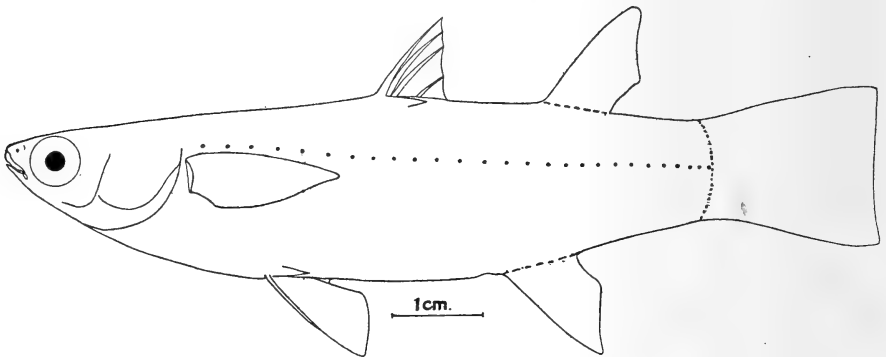


FIG. 16.—*Mugil waigiensis* Q. and G. (see note, fig. 3).

single. Upper lip thin, width at apex of snout $\frac{1}{5}$ of eye. No teeth in jaws or on palate. Exposed area on chin short and narrow.

D IV + I, 8, first dorsal inserted 1.1–1.18 times as far from tip of snout as from caudal base, 1.3 times as far from hind margin of mid-caudal rays as from tip of snout. First spine 1.9–2, base of first dorsal 3–3.5 in head. Distance from origin of first to origin of second dorsal 1.25 in head. First dorsal inserted above the 8th, second above the 16th–18th, lateral scale. Pointed sheath scale extends behind origin of first dorsal 3.3–4 in head, 6–8 in distance from origin of first dorsal to snout tip, 2.6–3.5 in distance from origin of first to origin of second dorsal. Second soft ray 1.6–1.8, base of second dorsal 3.6 in head. Edge of fin scarcely concave.

A III, 8, inserted in advance of second dorsal, below the 15th–16th lateral scale. Second ray 1.6 in head. Shape similar to dorsal.

P 16, 1.3 in head, tip reaches 7th–8th lateral scale, inserted 1.7–2.2 times as far from ventral as from dorsal profile. No axillary scale.

Ventrals 1.5–1.6 in head, inserted below 1.3 times as far from the

origin of the first dorsal as from hind margin of head. Edge of fin gently rounded. Axillary scale 3·5–4 in head.

Caudal almost truncate, lobes equal, mid-rays 1·3–1·4 in head.

Scales ctenoid, predorsal scales as long as wide, mucus canals short, lanceolate (Pl. XX, G and H); l.r. 26–28, l.tr. 9–10, 8 predorsal to above hind margin of head, 3 cheek scales.

Colour (Preserved).—Light brown, probably silvery in life. Pectorals partly or wholly dark. Vertical fins with dark margins. Dark longitudinal streaks.

Localities.—Chinde, Delagoa Bay.

Length.—Up to 100 mm.

Three specimens, from 44 mm. up, examined.

Easily distinguished from all other South African species by the small number of scales, together with the feebly emarginate caudal and the markings. Fowler's specimen from Delagoa Bay (Proc. Ac. Nat. Sci. Phil., 1925, vol. lxxvii, p. 209), described as *oligolepis* Blkr., does not appear to be very different from *waigiensis* (see notes under *oligolepis*). This author's figure of *waigiensis* (*loc. cit.*) differs in many respects from my specimens, and from most descriptions. The pectorals are shown to be about 1·8 in head, the first dorsal is inserted nearer the snout tip than the caudal base; the distance from the origin of the first to the origin of the second dorsal is about equal to the head, and there are 30 rows of scales: Day's figure (*loc. cit.*) is also rather singular in many respects. Barnard (*loc. cit.*) states that the maxilla is concealed. This is an error, if based on the S.A. Museum specimens.

The synonymy of this species appears to be somewhat extensive. A revision of material from all parts of its recorded area might show that several related species have been confused.

M. waigiensis is apparently widely distributed, and fairly common, throughout the whole of the Indo-Pacific region. It is not very common on our coasts.

From the outlines, this is probably a somewhat sluggish species.

Mugil oligolepis Blkr.

(Plates XXI, B, and XXII, C, D.)

1861. Günther, Cat. Fish. B.M., vol. iii, p. 452 (*melinopterus*, C. and V.?).

1888. Day, Fish. India, p. 358, pl. lxxvi, fig. 2.

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 245, and p. 246 (*melinopterus*, C. and V.).

1925. Fowler, Proc. Ac. Nat. Sci. Phil., vol. lxxvii, p. 209.

Body moderately robust, well compressed posteriorly. Head broad and depressed, snout slightly rounded. Front profile of snout fairly blunt, formed by upper lip. Depth 3.5, length of head 4.0 in length of body. Eye 4.1, snout 3.5, interorbital 2.2, postorbital length 2.0 in length of head. Adipose eyelids moderate, anterior weak, posterior better developed, covering about $\frac{1}{3}$ of the iris. Nostrils $\frac{1}{4}$ eye diameter apart, anterior slightly behind midway between anterior border of eye and snout tip profile. Lower margin of preorbital bent slightly downwards, not notched, edge strongly serrate. End of maxilla well exposed. Angle of lower jaw 106° , outline of jaw angular, margins slightly rounded; symphyseal knob single. Upper lip fairly thin, width at snout apex 4 in eye. Minute curved teeth in a single close-set series in upper jaw; lower jaw, vomer, and palatines edentate. A few small patches of minute teeth on the outer margin of the tongue. The medio-longitudinal ridge on the tongue higher than in other species. Prevomerine groove not very convex posteriorly. Exposed area on chin lanceolate, long and narrow, with anterior constriction.

D IV + I, 8. First dorsal inserted exactly midway between snout tip and caudal base, 1.4 times farther from the tip of the mid-caudal rays than from the tip of the snout. First spine 1.6, base of first dorsal 2.0 in head. The spines are very much stronger than those of any other South African species. They are also more close-set, the 4th not remote from the others, being apically almost adnate to the 3rd (this may possibly be a deformity). When the spinous dorsal is folded down, the exposed parts of the spines, excepting the anterior margin of the first, are scaly. Distance from origin of first to origin of second dorsal equal to head. First dorsal inserted above the 9th, second above the 19th lateral scale. Pointed sheath scale extends behind origin of first dorsal 2.1 in head, 4.4 in distance from snout tip to origin of first dorsal, and 1.1 in the postorbital part of the head. Longest soft ray 1.6, base of second dorsal 2.7 in head. Last ray very little longer than penultimate, fin not falcate, edge gently concave. Second dorsal completely scaly, with heavy basal scaly sheath.

A III, 9, anterior half of base in advance of second dorsal, inserted below the 16th lateral scale. Longest ray 1.5 in head, last ray scarcely longer than penultimate, edge of fin gently concave. Densely scaly, especially basally.

P 15, 1.25 in head, tip reaches to the 8th lateral scale, inserted twice as far from the ventral as from the dorsal profile. No axillary scale.

Behind and below the upper part of the base of the fin is a small scaled cutaneous projection. Fin scaly on basal half.

Ventrals 1.4 in head, inserted below 1.1 times nearer hind margin of head than origin of first dorsal. Edge of fin almost truncate, very slightly emarginate. Axillary scale 3.5 in head. Interventral scaly process rather wide and heavy.

Caudal forked, mid-rays 1.7 in head.

Scales very finely ctenoid; predorsal scales slightly longer than wide, mucus canal rather narrow (Pl. XXII, C and D). On the lateral scales the mucus canal posteriorly communicates with a system of rudimentary canals or grooves, more or less arborescent. Lat. ser. 27,

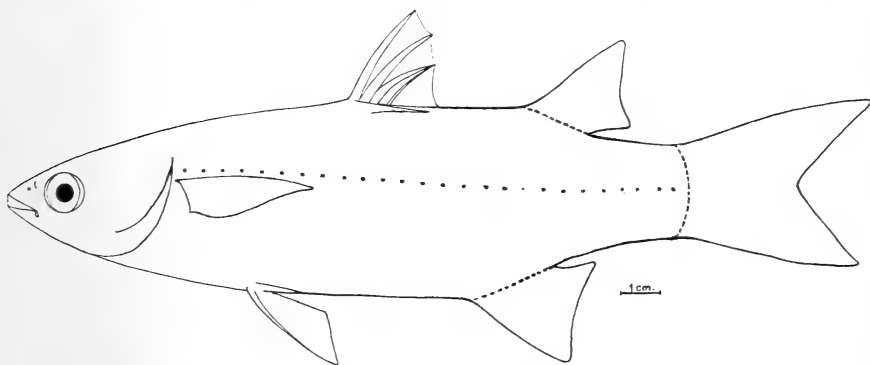


FIG. 17.—*Mugil oligolepis* Blkr. (see note, fig. 3).

l.tr. 10. Three cheek scales, 8–9 predorsal to above the hind margin of the head.

Colour.—Olive grey above, lighter below. Tips of dorsals darkish. Tip of upper lobe and hind margin of caudal dusky. Weak axillary spot. Faint streaks along the scale rows.

Locality.—Isipingo Lagoon, near the sea.

Length.—206 mm.

A single specimen examined.

A most rare and elusive species, sought for almost three years without success until recently. Not known as a separate species to the Indian netters in the neighbourhood of Durban.

This specimen is very probably conspecific with that described by Fowler (*loc. cit.*) from Delagoa Bay. Fowler's specimen had a narrower interorbital, while the markedly robust dorsal spines, obvious in my specimen, were not mentioned by him. Further, Fowler stated that the ventrals were 1.4 and the pectorals of his

specimen were 1.7 in head, but this may be an error. I have not seen any species of *Mugil* which has the pectorals so markedly shorter than the ventrals. Further, variation in length of the pectoral from 1.7 to 1.25 (my specimen) in head is far too wide for any one species.

Day's description and figure (*loc. cit.*) do not agree, and the latter, though most likely drawn from a juvenile, does not agree very well with my specimen. Nevertheless it is very likely that they are conspecific.

No descriptions of *oligolepis*, to which I have access, mention the posterior eyelid, which is very clear in my specimen.

It would not indeed be surprising to find that the synonymy of this species is somewhat extensive. Günther's account of *melinopterus* C. and V. (*loc. cit.*) fits my specimen almost exactly, whereas his account of *oligolepis* (*loc. cit.*, p. 449) does not.

M. nepalensis Gnthr. (*loc. cit.*, p. 424), of which I have seen no figure, and none but the original description, appears to be very closely related to, if not identical with, *oligolepis*.

There appears to be little of significance in Weber and de Beaufort's descriptions (*loc. cit.*) of *oligolepis* and of *melinopterus* to warrant their maintaining the two as distinct. In the length of the pectoral my specimen agrees with their account of *oligolepis*, whereas in the presence of the adipose eyelid it agrees with their *melinopterus*. It would appear that these two species are synonymous, or, at any rate, the specimens described by these authors are all of one species.

It may be noted that all descriptions of *oligolepis* that I have seen have been based on apparently juvenile specimens. A careful study of adequate material will probably show that *oligolepis* is merely the juvenile form of *melinopterus*.

SPECIES LIKELY TO BE DISCOVERED IN SOUTH AFRICA.

There are five species, widely distributed in the Indo-Pacific, which with more intensive collection will probably be found in our area. It seems desirable to indicate these, and to give a brief account of them and of their synonymy.

Those which occur in the Red Sea, or nearer our area, have been selected. Of these I have examined specimens of *caeruleomaculatus* Lacep. and of *speigleri* Blkr. only.

An abbreviated composite Key, to enable these species to be recognised, is appended.

Mugil tade Forsk.

1861. Günther, Cat. Fish. B.M., vol. iii, p. 426 (*parsia* H-B), and p. 427 (*belanak* Blkr.), and p. 428 (*planiceps* C. and V.).

1922. Weber and de Beaufort, Fish. Indo-Aust. Archip., vol. iv, p. 236.

1928. Fowler, Fishes Oceania, p. 122.

Adipose eyelids present. Maxilla exposed. Pectorals shorter than head without snout, with short axillary scale. Origin of first dorsal nearer snout tip than caudal base. Caudal feebly emarginate. D IV + I, 8-9, A III, 9, l.r. 33-35.

Distribution.—Indo-Pacific (Red Sea).

Mugil speigleri Blkr.

1861. Günther, *loc. cit.*, p. 435.

1888. Day, *loc. cit.*, p. 348.

1922. Weber and de Beaufort, *loc. cit.*, p. 241.

1928. Fowler, *loc. cit.*, p. 123.

Adipose eyelids present. Maxilla visible. Pectorals 1-1.15 in head, with long axillary scale. Scale at base of first dorsal as long as postorbital part of head. Origin of first dorsal nearer to snout tip than caudal base. Soft dorsal and anal densely scaled. Caudal forked. D IV + I, 8; A III, 9; l.r. 40-42.

Distribution.—Indo-Malayan area (Red Sea).

Mugil cunnesius C. and V.

1861. Günther, *loc. cit.*, p. 434.

1922. Weber and de Beaufort, *loc. cit.*, p. 242.

1928. Fowler, *loc. cit.*, p. 123.

Adipose eyelids present. Maxilla exposed. Pectorals shorter than head without snout, with long axillary scale. Origin of first dorsal nearer snout tip than caudal base. Soft dorsal and anal scaleless. D IV + I, 8; A III, 9; l.r. 42-43.

Distribution.—Indo-Malayan area (Red Sea).

Mugil labiosus C. and V.

1861. Günther, *loc. cit.*, p. 454.

1922. Weber and de Beaufort, *loc. cit.*, p. 259, fig. 67.

1928. Fowler, *loc. cit.*, p. 126.

Upper lip very thick, with a single series of papillae.

No adipose eyelids. Maxilla exposed (but stated to become hidden in large specimens?). Pectorals as long as head, with short axillary scale. First dorsal about midway between caudal base and snout tip. Caudal emarginate. D IV + I, 7-8; A III, 9-10; l.r. 34-36.

Distribution.—Indo-Malayan area (Red Sea).

Mugil caeruleomaculatus Lac.

1922. Weber and de Beaufort, *loc. cit.*, p. 250.

No adipose eyelids. Maxilla concealed. Pectorals 1.1 in head, with long axillary scale. First dorsal nearer snout tip than caudal base, or midway. Scale at base of first dorsal long, 1.8 in head, about as long as postorbital part of head. Caudal forked. No exposed area on chin. D IV + I, 8; A III, 9; l.r. 36-38.

Distribution.—Indo-Pacific (Zanzibar?).

ABBREVIATED COMPOSITE KEY.

I. Adipose eyelids well developed, covering most of the iris

posteriorly.

A. Scales 33-36.

1. Pectorals longer than head without snout *strongylocephalus*.
2. Pectorals not longer than head without snout *tade*.

B. Scales 38-43.

1. Anal with 7-8 soft rays *cephalus*.
2. Anal with 9 soft rays.
 - a. Maxilla concealed *robustus*.
 - b. Maxilla exposed.
 - i. Soft dorsal completely scaly *speigleri*.
 - ii. Soft dorsal not scaly *cunnesius*.

II. Adipose eyelids small or rudimentary, covering not more than half of the posterior portion of the iris.

A. Upper lip very thick, almost half eye diameter at snout tip, with papillae on lower margin.

1. Papillae in 5 or 6 series. Pectorals 1.3-1.4 in head. Scales 37-40 *crenilabis*.
2. Papillae in one series. Pectorals 1-1.1 in head. Scales 34-36 *labiosus*.

B. Upper lip not more than $\frac{1}{3}$ eye deep at snout tip, without papillae.

1. Dorsal scales multicanalicate. (Pectorals 1-1.1 in head) *canaliculatus*.
2. Dorsal scales not multicanalicate.
 - a. Scales 41-49 (caudal forked).
 - i. Pectorals not longer than head without snout.

- x. Soft dorsal completely scaly *euronotus.*
 - y. Soft dorsal not completely scaly *capito.*
 - ii. Pectorals longer than head without snout.
 - x. Teeth tricuspid. Maxilla exposed *tricuspidens.*
 - y. Teeth not tricuspid. Maxilla concealed *seheli.*
- b. Scales 29-40 (caudal forked).
 - i. End of maxilla concealed.
 - x. Pectorals longer than head without snout.
 - a. Scale at base of first dorsal shorter than $\frac{3}{4}$ of post-orbital part of head.
 - * Scales 38-42 *seheli.*
 - ** Scales 33-36 *buchanani.*
 - β . Scale at base of first dorsal about as long as post-orbital part of head *caeruleomaculatus.*
 - y. Pectorals not longer than head without snout *robustus.*
 - ii. End of maxilla exposed.
 - x. Ventrals longer than head without snout *compressus.*
 - y. Ventrals shorter than head without snout *macrolepis.*
- c. Scales 26-28.
 - i. Caudal almost truncate. Pectorals black *waigiensis.*
 - ii. Caudal emarginate. Pectorals light *oligolepis.*

HABITS, BREEDING HABITS, ETC.

The general habits of Mulletts are fairly well known, since these fishes live mainly inshore, on the surface and in shallow water. They are fairly easily captured and appear to thrive in aquaria.

In the latter may be seen how they project the mouth as a scoop and suck in sand or mud, triturate this for a time, and finally reject what has proved inedible.

Mulletts appear to be largely herbivorous, but will eagerly feed upon soft flesh, such as the liver or intestines of fishes, even of their own kind. They will also take insects which have fallen into the water. At Knysna I have observed a shoal feeding upon fallen flying ants which were over the water. Despite this, the species do not appear to take an artificial fly.

The intestinal contents nearly always consist very largely of sand. The intestine is very long, and the unabsorbed residue from the alimentary tract is little else but sand and shell particles. In the stomach itself, besides sand and mud, green algae, and fragments of marine plants, may occasionally also be found eggs, larval crustacea and fishes.

In tidal estuaries these fishes appear to congregate, especially at night, upon the sand- or mud-banks, where the mud and the eel-grass (*Zostera*) both teem with many lowly forms of life. From a boat I have watched shoals of small half-grown *Mugil* feeding. They swim in a compact body, facing the current, moving at the rate of a few inches a minute. They constantly suck up the mud, or the slime on the grass, retain it for perhaps 20 or 30 seconds, and eject the hard portion. The movements of such a shoal are extremely erratic. In the van are often to be seen a number of individuals who shoot forward some inches and then drop back into the main body. The shoal will veer as a whole to one side, or will move rapidly forward for a few feet and then resume the slow advance. Occasionally a shoal will be seen to break up, dart some distance back, and cover the same area at a slow pace.

These small shoals nearly always consist of individuals of more or less constant size. On one occasion only did I see a large specimen feeding with a shoal of others of very much inferior size. A lucky cast with a throw-net secured this specimen, which proved to be *cephalus*, while the others were *canaliculatus*.

I have never been fortunate enough to see a shoal of large specimens feeding in this manner. At night, with a powerful light, I have frequently been among large numbers of adults, but only occasional specimens came into the light; these were merely swimming idly and appeared uneasy, some sheering off wildly for no apparent reason, while others would swim until almost against the side of the boat before taking fright.

Mulletts seem to be timid, but exceedingly curious. From a high rock, overlooking moderately deep water, I have dropped stones into the middle of a shoal. The fishes scatter widely, but almost immediately turn and circle in a dense cloud in the disturbed area. If a handful of crushed liver be thrown amongst them, the same performance results, and a fierce mêlée ensues until all has been consumed. Any sudden movement of an exposed part of the observer results in the rapid departure of the shoal, if the fishes be of any size.

"Harders" are generally captured by means of nets, but specialised

methods of angling are also employed with success. In tidal rivers very small hooks mounted on fine gut, buoyed with small corks and baited with dough, or with various fancy concoctions, are employed. In the sea at various places, liver or fish bait on tiny hooks is generally used. A large "Harder" or "Mullet," especially *tricuspidens*, provides magnificent sport on light tackle. Successful angling depends upon a close study of the habits of these fishes, and requires considerable skill and patience; this sport has not yet found favour with the majority of anglers in South Africa.

In the fresh waters of the Eastern Province "Springer" (*euronotus*) fishing is largely indulged in. To the line near the hook are fastened a number of small corks in a series, so as to keep 4 or 5 feet of the line on the surface. At the end, on some inches of fine gut, is mounted a small hook. The favourite lure is a "flying-ant." The fishes usually bite well towards evening, and large catches are frequently made.

In the Eastern Province the majority of the species appear to breed in September and October. The shoals come into shallow water all along the coast, and at night lie in the shallows, where the eggs are presumably shed and fertilised. At this time the fishes appear to be much less timid, and, by the aid of a light, may at night be scooped up in numbers with a landing net. I have in this fashion secured numbers in pools at the edge of the surf, both males and females, fully ripe. The females appear to outnumber the males by as much as ten to one.

It has frequently been stated that ripe fishes seek out tidal estuaries for the purpose of spawning. The evidence I have been able to obtain does not substantiate this belief, which is probably only partly correct. The fishes are certainly more plentiful in such waters at these times, but I have observed that they are also more numerous in the shallow water of the sea itself.

In estuaries, when every fish taken was ripe, I have at night, from a boat, with the aid of a light observed from two to four fishes slowly circling over shallow water on mud-banks. On some occasions, in still water, I have been able to keep them in the illuminated area for as long as ten minutes. On occasions there has appeared to be an ejection of faintly opalescent matter which instantly disappeared, but this has not been observed to be followed by the ejection of milt. I have several times captured, with a throw-net, two or three specimens so engaged, and on each occasion one of the fishes proved to be a ripe male, the remainder females, so it may be presumed that

they were engaged in spawning. It is, nevertheless, singular that tow-netting over these presumed spawning areas has in no case resulted in a catch containing eggs which could be shown to be those of ripe *Mugils*.

The somewhat oily flesh of the "Harder" is of fine texture and delicate flavour, and probably of relatively high calorific value.

These fishes are, especially in the Western Province of South Africa, highly esteemed, and a large "Harder," baked whole, is undoubtedly a culinary delicacy.

Vast numbers are caught annually, chiefly by drag-nets, whole shoals being encircled in the surf. On the west coast fair numbers are taken by floating gill-nets, anchored near the shore.

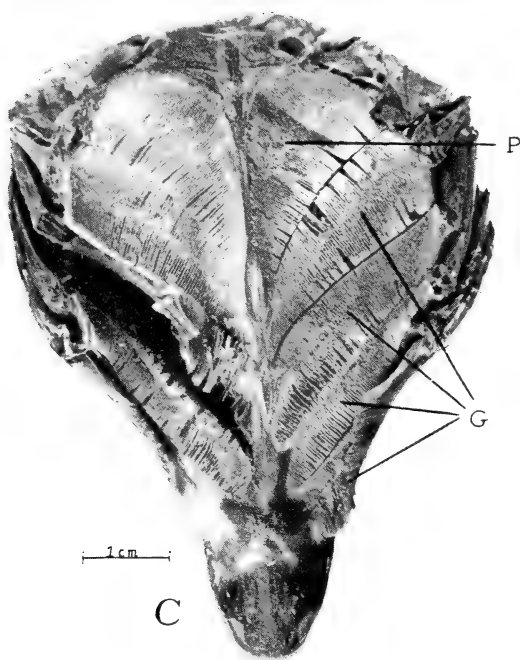
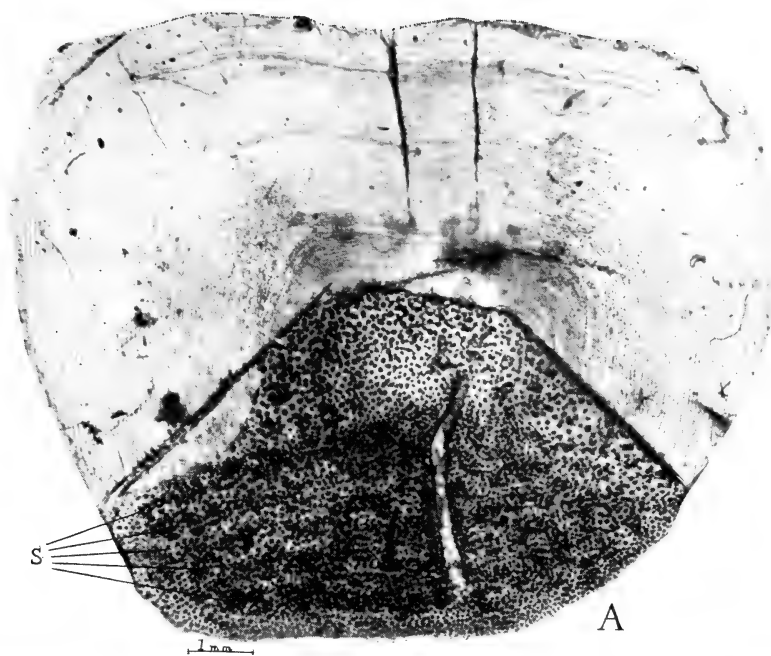
Large numbers are salted and dried, and these form an important part of the diet of the poorer section of the coastal population.

The flesh of those fishes taken far up in estuaries is generally slightly less palatable, while those taken from the inland waters of the Eastern Province have a distinctly unpleasant "muddy" flavour.

I wish to express my gratitude to the Director of the South African Museum for his kindness in assisting with the loan of the whole of the S.A. Museum collection of *Mugil* species, and of literature. To the Research Grant Board of South Africa (Carnegie Fund) for generous financial assistance, which has defrayed the greater part of the expenses incurred in the investigation. Also to Messrs. H. J. Koch and B. Hindson for valuable collections from Natal.

I must also acknowledge my indebtedness to Dr. C. von Bonde, Director of the Government Fisheries Survey, and to Mr. Bell-Marley, Principal Fisheries Officer of Natal, for permission to net in preserved waters.

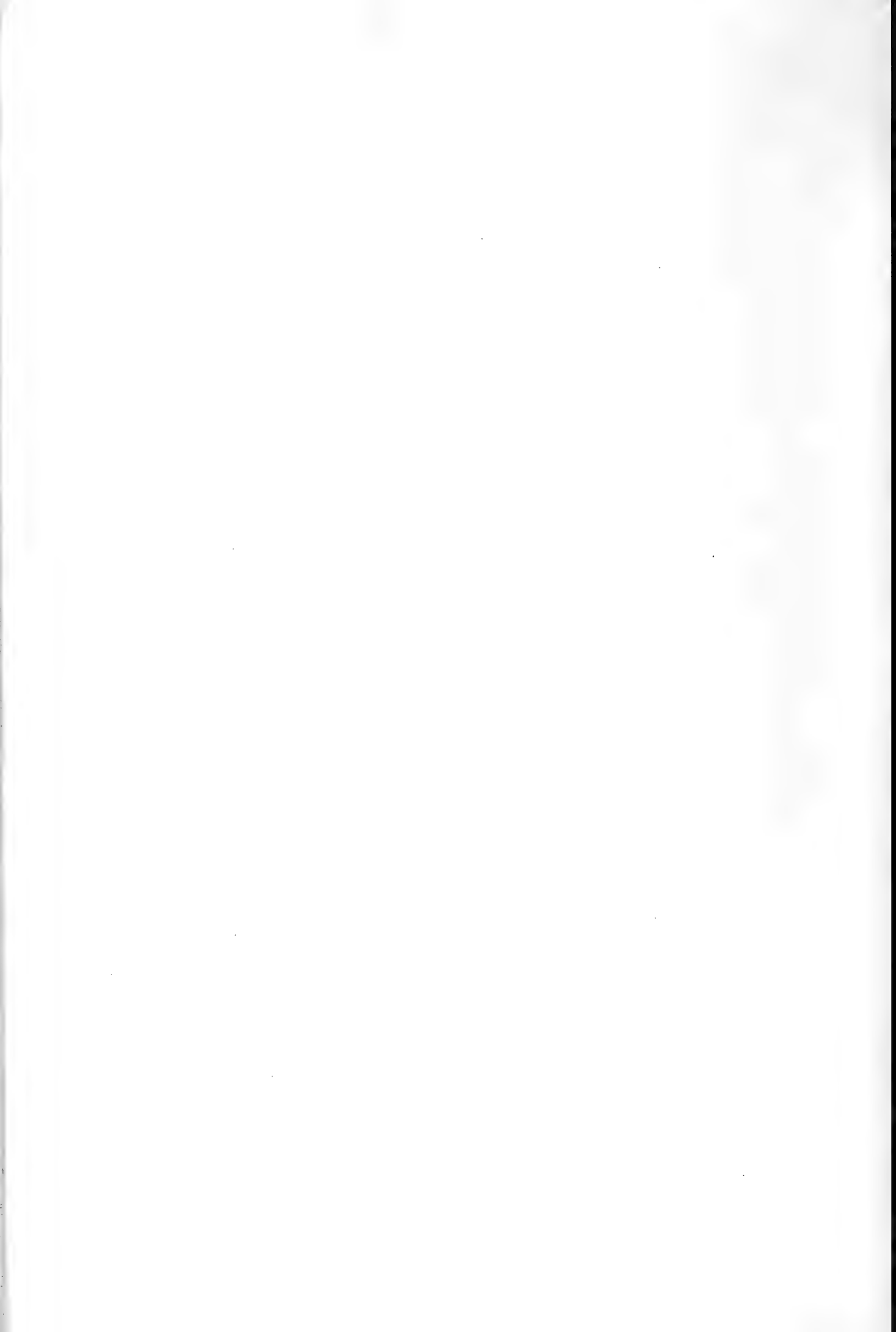
ALBANY MUSEUM,
GRAHAMSTOWN,
July 1934.

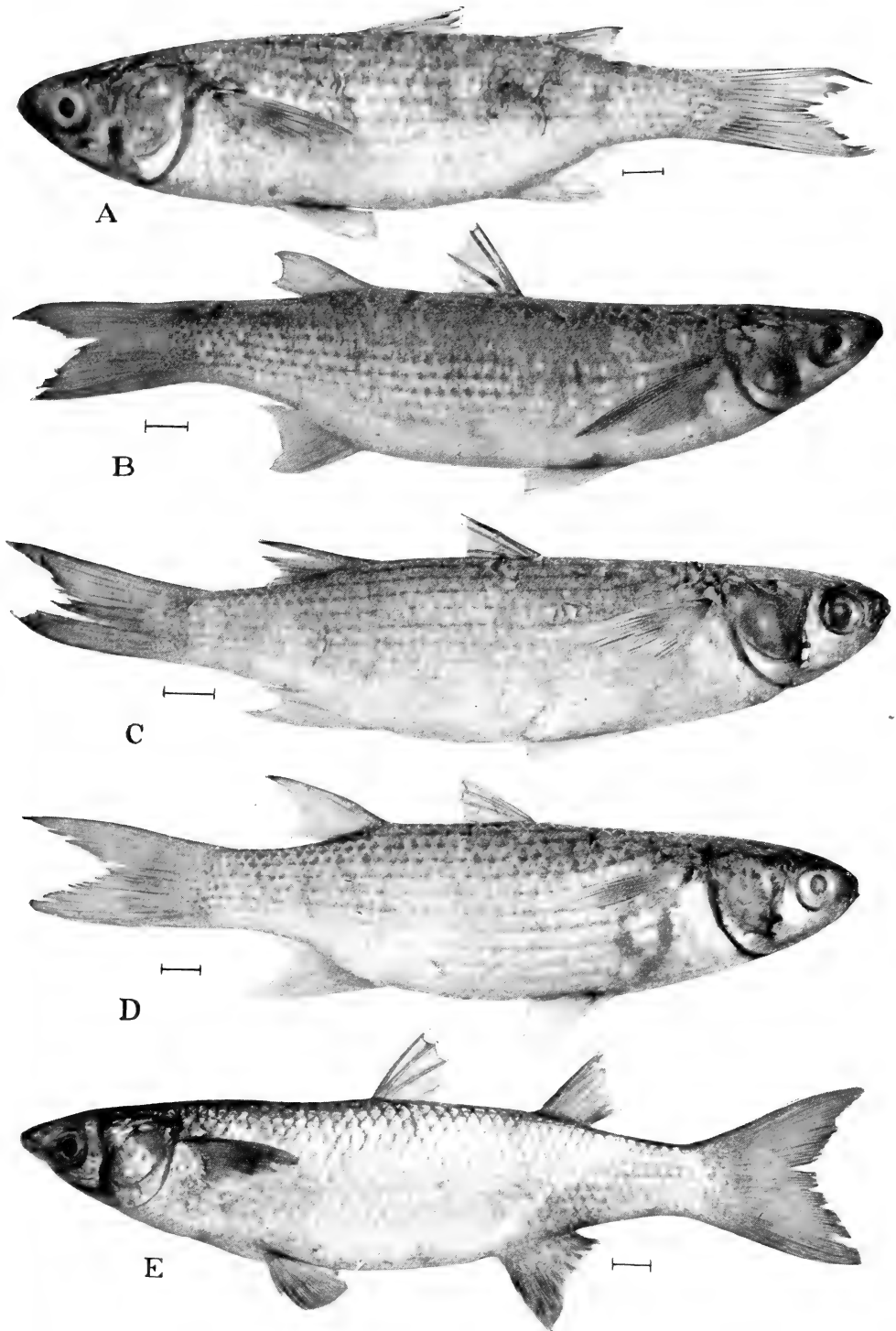


A, Latero-occipital scale of *Mugil cephalus* Linn., from specimen 405 mm. in length, to show secondary scaling. The lines radiating from S indicate rows of minute superimposed scales.

B, A portion of the integument, from a medio-lateral scale of the same species (length 275 mm.), showing the small cycloid scales embedded therein.

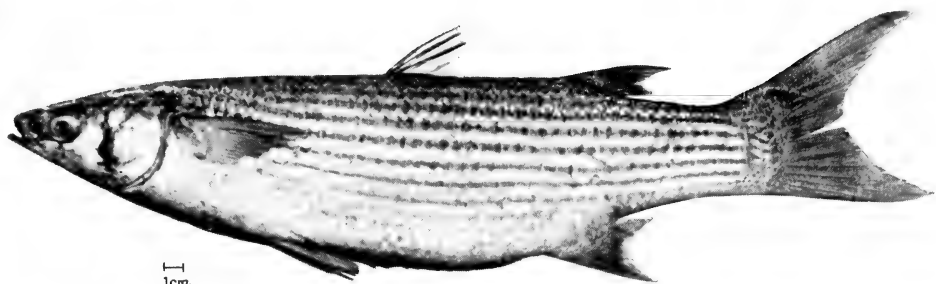
C, View of the branchial and lower pharyngeal regions of the same species (length 405 mm.). G, Rakers of the four branchial arches; P, Pharyngeal rakers.



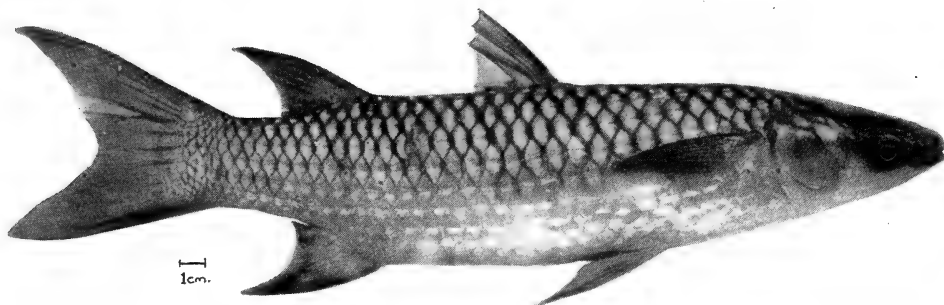


Mugil species. A, *strongylocephalus* Rich.; B, *canaliculatus* n. sp.; C, *seheli* Forsk.; D, *buchanani* Blkr.; E, *euronotus* A. Smith. The line below each figure represents 1 cm.





A



B



C



D



E



F



G

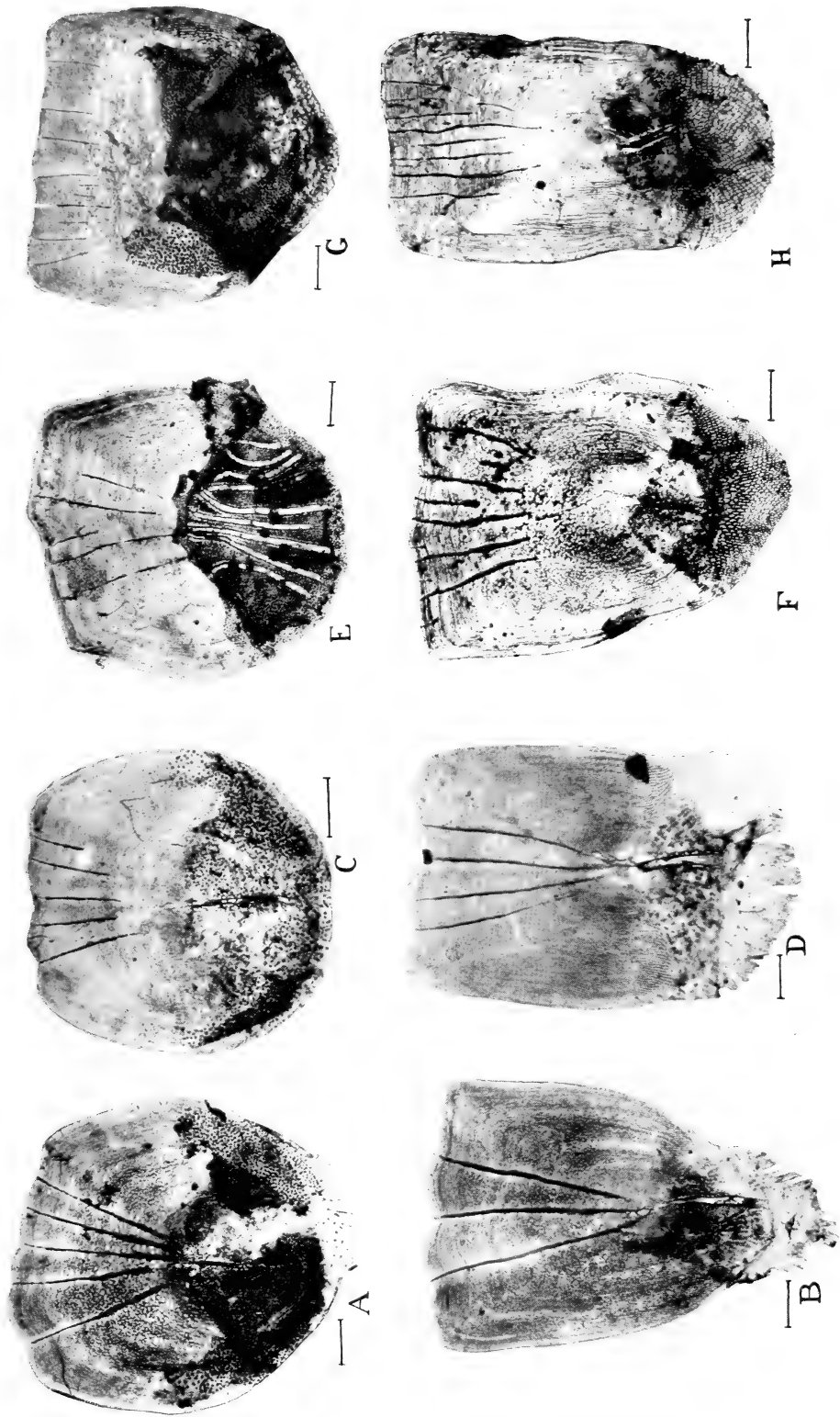
A, *Mugil tricuspidens*, n. sp.; B, * *Mugil compressus*, Gnthr.

C-G, premaxillary teeth of *Mugil* species. The total length of the specimens from which the teeth were taken is given in brackets. The line below each figure represents a tenth of a millimetre.

C, *capito* Cuv. (280 mm.); D, *canaliculatus* n. sp. (210 mm.); E, *euronotus* Smith (230 mm.); F, *tricuspidens* n. sp. (60 mm.); G, *tricuspidens* n. sp. (405 mm.).

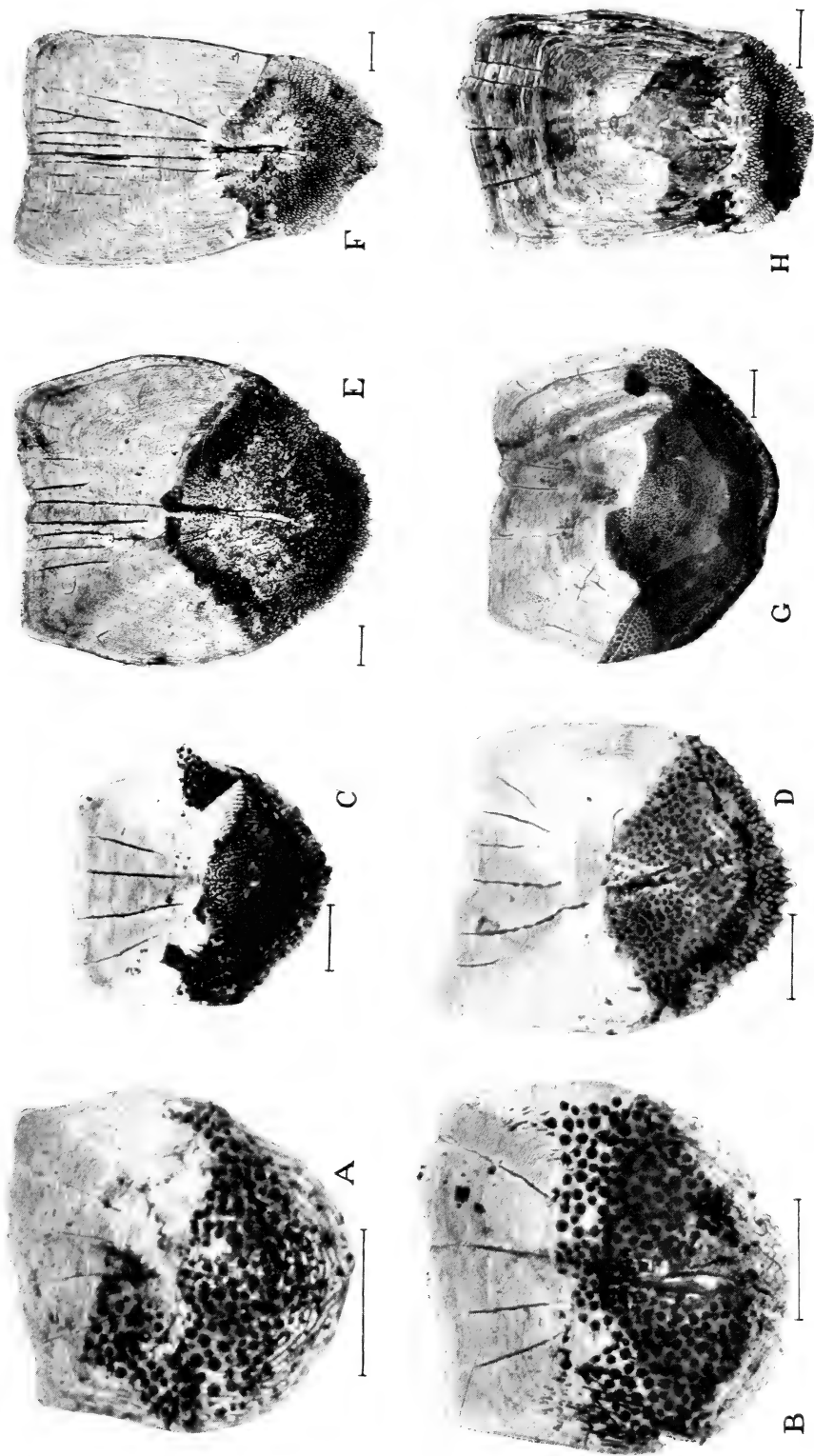
* Copied by permission, from a photograph taken by the Director of the Natal Museum.





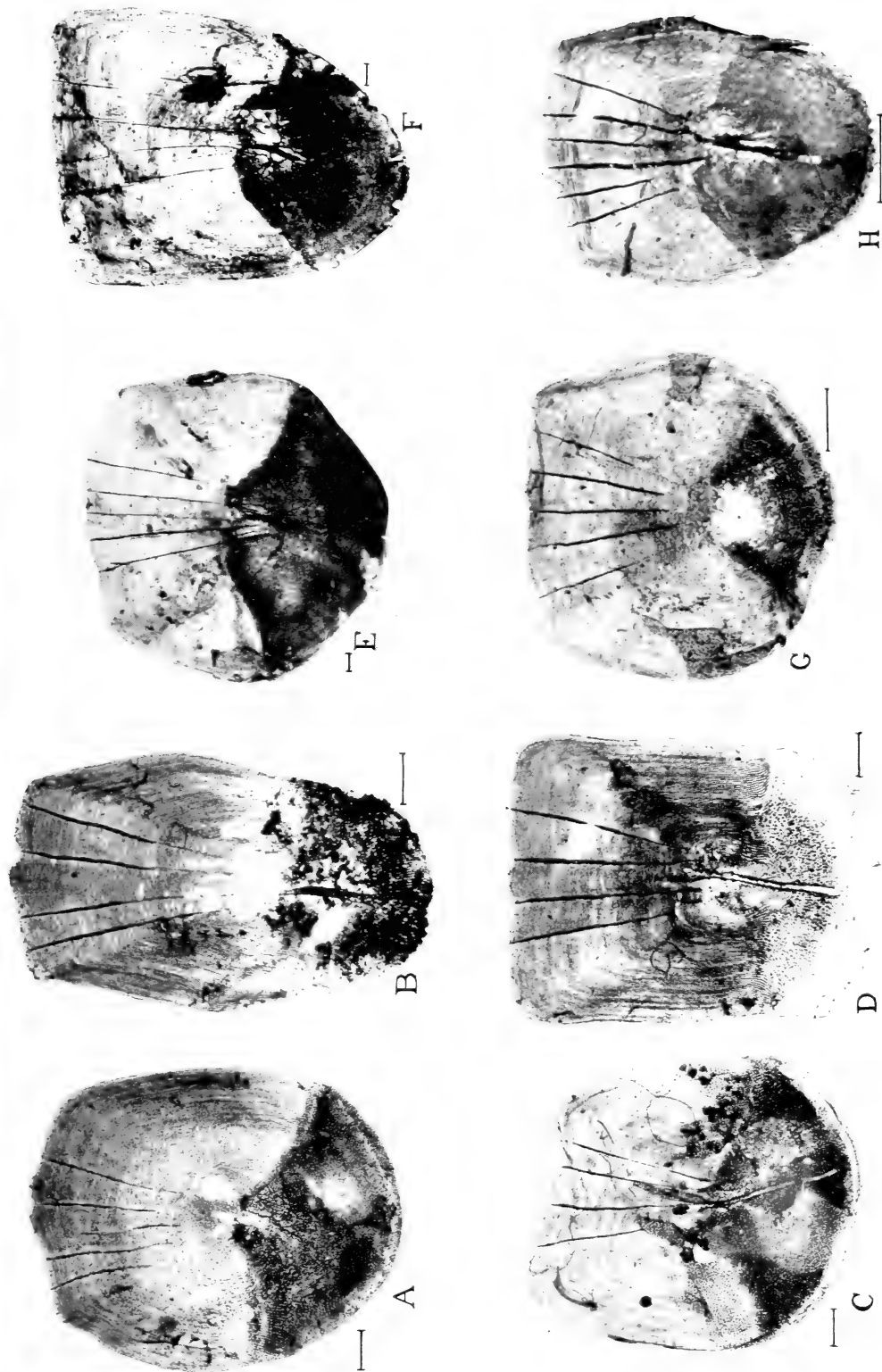
7th predorsal and mid-postventral scales of *Mugil* species. Predorsal scales are the first of each pair. The line below each scale represents 1 mm. The total length of the specimen from which the scale is taken is given in brackets. A and B, *strongylocephalus* Rich. (195 mm.); C and D, *schalk* Forsk. (167 mm.); E and F, *canaliculatus* n. sp. (254 mm.); G and H, *tricuspidens* n. sp. (260 mm.).





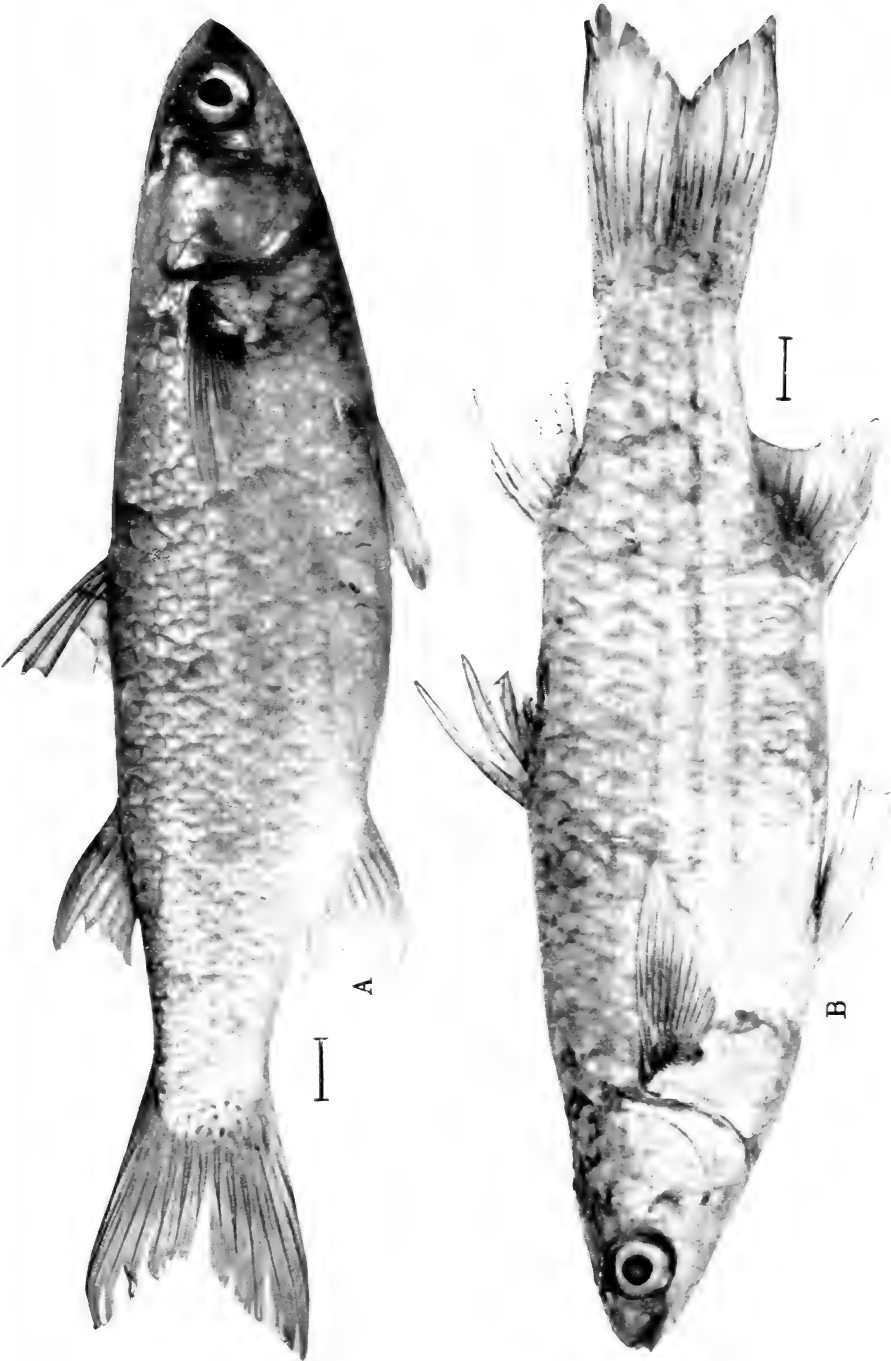
7th predorsal and mid-postventral scales of *Mugil* species. The total length of the specimen from which the scale is taken is given in brackets. The line below each scale represents 1 mm.
A-E inclusive, 7th predorsal scales of *capito* Cuv.: A (95 mm.), B (110 mm.), C (120 mm.), D (140 mm.), E (230 mm.); F, mid-postventral scale of *capito* Cuv. (230 mm.); G, 7th predorsal scale of *euronotus* Smith (225 mm.); H, mid-postventral scale of same.





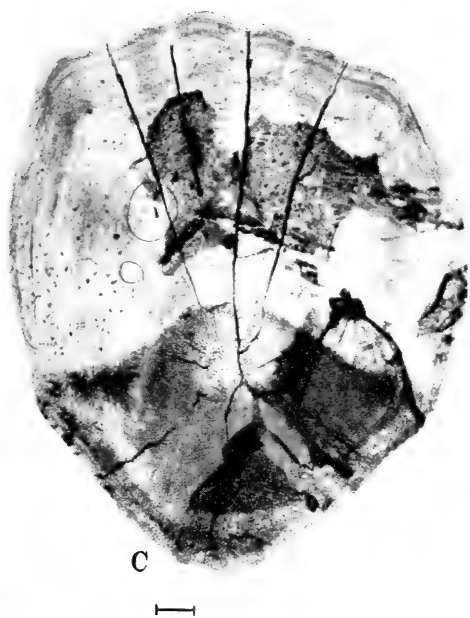
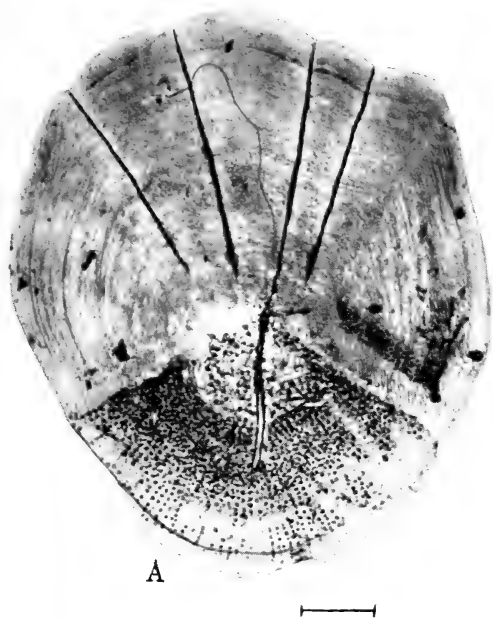
7th predorsal and mid-postventral scales of *Mugil* species. The first of each pair is the predorsal scale. The line below each scale represents 1 mm. The total length of the specimen from which the scale is taken is given in brackets. A and B, *macrolepis* Smith (117 mm.); C and D, *buchanani* Blkr. (200 mm.); E and F, *compressus* Gthr. (350 mm.); G and H, *waigiensis* Q. and G. (100 mm.).





A, *Mugil robustus* Gunth.; B, *Mugil oligolepis* Blkr.
The line below each figure represents 1 cm.



Scales of *Mugil* species.

A, 7th predorsal of *robustus* Gnthr. (200); B, mid-postventral of same; C, 7th predorsal of *oligolepis* Blkr. (206); D, mid-postventral of same.

The line below each figure represents 1 mm. The length of the specimen, in millimetres, from which the scales were taken, is given in brackets.



20. *Notes on South African Marine Fishes*.—By K. H. BARNARD,
D.Sc., F.L.S., Assistant Director.

(With Plates XXIII–XXV and 7 Text-figures.)

THIS paper continues that published in February 1934 (Ann. Mag. Nat. Hist., ser. 10, vol. xiii, pp. 228–235), and contains two new records; the description of a new genus and species of Clinid; an account of certain anatomical features of *Rhineodon*; and notes on pug-headedness in a species of *Pagrus*, and on an abnormal specimen of *Mola* and on the gill-filaments of this genus.

Apogon orbicularis C. and V.

1873. Günther, *Fische d. Südsee*, vol. i, p. 22, pl. 20, fig. D.

1878–88. Day, *Fish. India*, p. 65, pl. 17, fig. 7.

This well-known Indian species has been received from Mozambique.

Dascyllus aruanus Linn.

1877. Bleeker, *Atl. Ichth.*, ix, pl. 409, fig. 6 (*Tetradrachmum arcuatum*).

1876–81. Günther, *Fische d. Südsee*, vol. ii, p. 235, pl. 124, fig. B.

1878–88. Day, *Fish. India*, p. 381, pl. 80, fig. 6.

Also received from Mozambique. The colour pattern resembles that of Günther's figure.

FAM. CLINIDAE.

Climacoporus n.g.

Resembling *Clinus* and *Clinoporus*. Hook on inner margin of shoulder-girdle present. Body densely covered with minute scales, distinctly imbricate only on posterior half of body. Anterior nostril shortly tubular. A palmate supraorbital tentacle. Head naked, pores mostly in double rows. Lateral line a broad, well-marked

canal opening by paired pores, the upper and lower pores opposite one another (not alternate as in *Clinoporus*), and joined by a slight cuticular ridge, thus resembling a ladder.

Climacoporus navalis n. sp.

(Text-fig. 1.)

Body elongate, moderately compressed. Depth $5\frac{1}{3}$, length of head 4, in length of body (caudal excluded). Eye slightly greater than

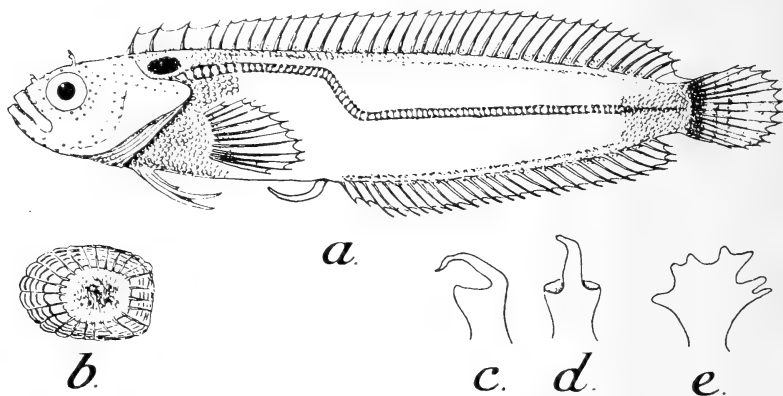


FIG. 1.—*Climacoporus navalis* n.g., n.sp. *a*, whole animal, scaling on body only partly indicated. *b*, scale. *c*, *d*, left anterior nostril from the side and from behind. *e*, left supraorbital tentacle from behind.

snout, 4 in length of head. Profile of head slightly convex. Anterior nostril shortly tubular, with a short filament arising from hind margin of rim; posterior nostril slightly larger than the head pores, but scarcely tubular. A transversely flattened, palmate supraorbital tentacle. Maxilla reaching to vertical from anterior third of eye. A band of smaller teeth behind the front row in both jaws, and a curved band on vomer. Branchiostegals 6. Gill-rakers 5-6 on lower part of anterior arch, very feeble. D XXXVII 1, beginning above hind edge of pre-opercle, spines increasing in length up to about the 30th, the first 4 more widely spaced than the others, especially the 2nd and 3rd, and 3rd and 4th, the single ray connected by membrane with the base of caudal fin. A II 24. P 12. V I 3, 3rd ray minute. C 15 (13 main rays). Lateral line with 77 pairs of pores, 24 to the downward curve, 10 on the bend, which occurs between the verticals from the 12th and 14th spines, and 43 on the straight hinder part,

which ends in 1-2 single pores at the vertical from the 35th spine; a slight groove, covered with ordinary scales, continues to base of caudal.

Length.—64 mm.

Colour.—Reddish or maroon-brown, with faint darker blotches appearing after preservation, an oval dark ocellus with pale border between origin of lateral line and 2nd-3rd dorsal spines, a dark band across base of caudal, followed by 2 narrower bands and a few irregular spots, margin of anal fin pale.

Locality.—Simonstown, False Bay, collected off the training ship *General Botha* on entering the naval dry-dock (16th June 1933, 1 ♂, K. H. B.).

Rhineodon typus A. Smith.

(Plates XXIII-XXV and Text-figs. 2, 3.)

1925. Barnard, Ann. S. Afr. Mus., xxi, p. 37 (*Rhinodon typicus*).

1930. White, Bull. Amer. Mus. Nat. Hist., lxi, p. 129.

1931. Gudger, *ibid.*, p. 613.

1933. *Idem*, Nature, No. 3336, p. 569.

1934. Barnard, *ibid.*, No. 3376, p. 66.

A specimen, approximately 20 feet in total length, was found washed up on the beach at Kommetje, on the west side of the Cape Peninsula. It was stated to have been found at Easter (April 2nd) 1934, but unfortunately was not reported to the Museum until three weeks later. On 23rd April my colleague Dr Lawrence and I examined the specimen, and on the following day we cut off the upper half of the skin and the whole of the head, tail, and pectoral fins. Owing to hot dry weather the upper exposed parts were more or less mummified, but the lower surface was badly decomposed and impossible to save.

On arrival at the Museum Mr. Drury, the taxidermist, decided against mounting the remains of the skin. The best portions of the skin, however, were dried, and the fins and certain parts of the head were preserved for anatomical study.

White (1930, p. 157) has indicated three anatomical features requisite for forming a correct idea as to the true systematic position of the whale-shark, viz. the presence or absence of oro-nasal grooves, the rostral cartilages, and the pectoral fin. All these have been studied on the present specimen.

Some of the more important measurements may be given for comparison with other specimens:

	ft.	in.
Length, total	20	—
Tip of snout to origin of 1st dorsal	8	8
" " " 2nd " 	12	5
" " root of tail	14	10
Base of 1st dorsal	1	6
" 2nd " 	—	8
Upper caudal lobe	5	2
Lower " " 	3	—
Span between tips of caudal lobes	5	6
Pectoral (anterior base to tip)	3	—
Width around snout, eye to eye	4	—
Width across forehead, eye to eye	3	6
Width at bases of pectorals, over shoulders	4	8
Eye to 1st gill slit	2	1
" 4th " 	3	5
Eye (hind margin of) to spiracle	—	3 $\frac{3}{4}$
Eye diameter	—	1
Spiracle	—	1 $\frac{1}{4}$
Width of mouth	2	4
" lower dental band	1	10
" upper " " 	1	2 $\frac{1}{2}$
" tongue	1	1 $\frac{1}{2}$
Centre of upper jaw to nostril	—	10
Nostril to eye	1	—
" angle of mouth	—	5 $\frac{1}{2}$
Eye to angle of mouth	—	7
Lower end 5th gill-slit to hind corner pectoral fin	1	10
Caudal peduncle (at root of tail) vertical diam.	—	6 $\frac{1}{2}$
" " " " horizontal diam.	—	5
" " width of keel	—	1
Tip of snout to origin of mid-dorsal keel (which is approx. at vertical from 1st gill-slit)	3	—
Length of 1st-5th gill-slits, resp. 15, 16, 17, 15, 12 $\frac{1}{2}$ inches.		
Distances of upper ends of gill-slits to mid-dorsal line, re- spectively 12 $\frac{1}{2}$, 11 $\frac{1}{2}$, 10 $\frac{1}{2}$, 10 $\frac{1}{2}$, 11 $\frac{1}{2}$ inches.		
Distance apart, each pair of gill-slits 4 $\frac{1}{2}$ -5 inches.		

From these measurements Mr. Drury has constructed a half-size model for exhibition in the Museum (Pl. XXIII). For purposes of this construction Mr. Drury studied Gudger's 1931 paper with the photographs and drawings there given of the known mounted specimens. He noticed a very definite discrepancy between the photographs of the *model* in the American Museum (pls. 23, 24), and those of the other specimens mounted or figured, viz. the relation between the pre-pectoral and post-pectoral lengths. In the American Museum

model the post-pectoral length (posterior base of pectoral to root of caudal) is three times the pre-pectoral length (tip of snout to anterior base of pectoral); in Bean's figure (Gudger, *loc. cit.*, pl. 28) and the sketch of the Tokyo specimen (*loc. cit.*, fig. 4) it is $2\frac{1}{2}$ times. In all the other figures the post-pectoral length is only twice the pre-pectoral length, though the British Museum mount (*loc. cit.*, pl. 31) shows it slightly over twice, the posterior part of the body having apparently been too much stretched out in mounting. The pre-pectoral length is approximately equal to the distance between the posterior base of pectoral and the ventrals. Our present specimen corresponds with Smith's original figure (1849), which remains far and away the best representation (photographic or otherwise) yet given of this shark.

On the other hand, this specimen differs from all the figures, including Smith's, which show the position of the 4th gill-slit. Instead of this gill-slit being over the base of the pectoral, *i.e.* with the pectoral arising below and in front of it, here it is definitely in front of the pectoral origin and extends below it in a ventral direction. The above given measurements of the lengths of the gill-slits and their distances from the mid-dorsal line indicate the position. See also Pls. XXIV and XXV.

Cephalic Mucus Canals.—Where these could be traced, they run as in the accompanying diagram (fig. 2). The aural canal is about 18 inches from the end of the snout, and about 15 inches in front of the level of the 1st gill-slit. At the latter level the lateral line is 6 inches from the medio-dorsal keel; it curves below the forked dorso-lateral keels and at the level of the 1st dorsal fin is about 16 inches from the centre line. A portion of the jugular canal was traced close below the spiracle, but the sub-rostral, nasal, and oral canals could not be traced owing to the decomposed condition of the skin. It is unfortunate that the oral canal could not be traced, as its completeness or incompleteness across the symphysis might help to determine the systematic position of *Rhineodon* (see Garman, 1888, Bull. Mus. Comp. Zool., xvii, 2, pp. 68, 72).

Oro-nasal Grooves (Pl. XXV).—Dr. White (*loc. cit.*, p. 153) states that the nostril is not truly confluent with the mouth, and that the upper lip is not divided into three parts, but adds that further investigation is required. The figure she gives is not too clear. A photograph of the nostril and portion of the jaw is here given, which fully confirms Dr. White's statement that oro-nasal grooves are absent.

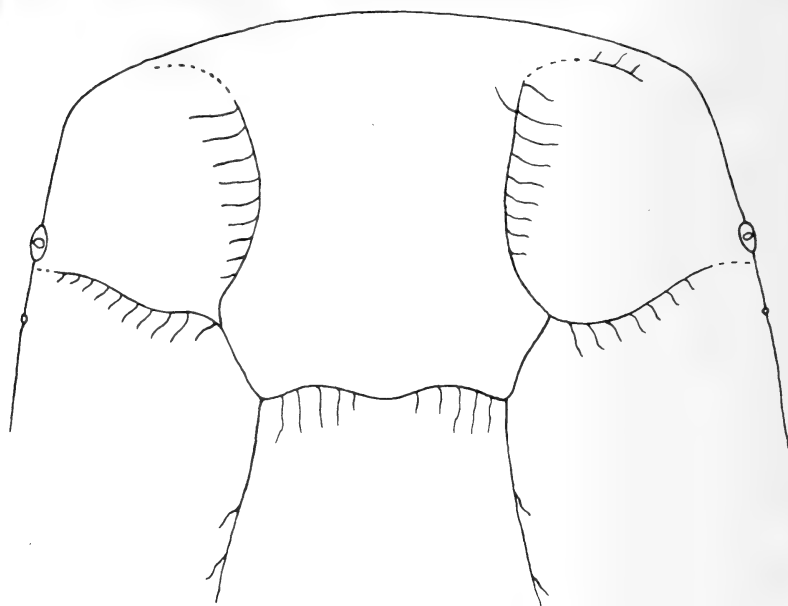


FIG. 2.—*Rhineodon typus*. Dorsal view, cephalic mucus canals. Dotted portions not actually traced on the skin.

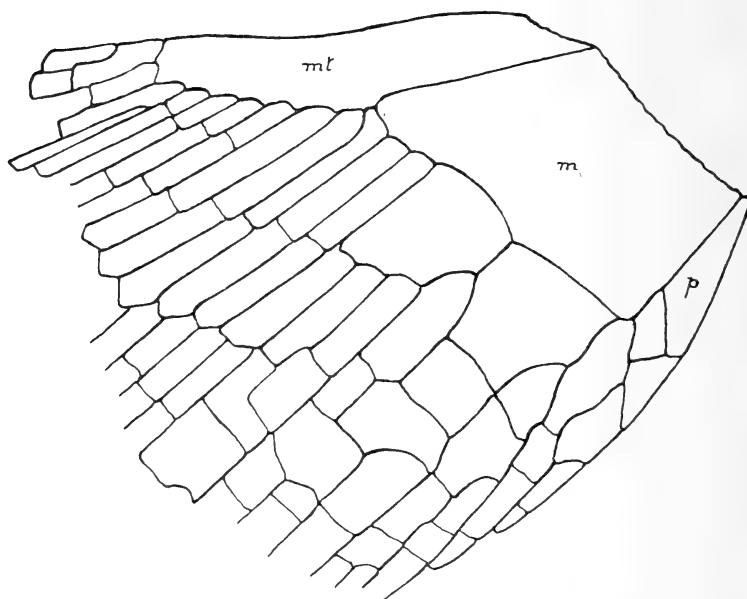


FIG. 3.—*Rhineodon typus*. Skeleton of pectoral fin. *p*, propterygium; *m*, mesopterygium; *mt*, metapterygium.

Though Garman's statement (*Plagiostomia*, 1913, p. 41) that oronasal grooves are present is thus shown to be incorrect, the absence of these grooves supports Garman and White in their contention that *Rhineodon* is not an *Orectolobid*, in which family Tate Regan placed it (P.Z.S., 1906, p. 745, and 1908, p. 352).

Rostral Cartilages.—As might be expected, the rostral cartilages are completely obsolete. The anterior margin of the skull follows an even, slightly convex course between the olfactory capsules.

Pectoral Fin (fig. 3).—The propterygium is well developed and excludes the mesopterygium from the margin of the fin. The mesopterygium is extraordinarily broad. The absence of a foramen between the mesopterygium and metapterygium is a further point against the inclusion of *Rhineodon* in the *Orectolobidae* (Regan, P.Z.S., 1906, p. 744).

Simocephaly in *Pagrus laniarius*.

(Text-fig. 4.)

Recently Mr. C. L. Biden obtained in Kalk Bay, False Bay, a specimen of *Pagrus laniarius*, locally known as the "Panga." It is 270 mm. in length, and is a typical *laniarius*, except for the profile of the forehead and snout. The profile somewhat resembles that of the large *Dentex undulosus* figured in Ann. S. Afr. Mus., xxi, p. 720, fig. 26, but when compared with the normal *laniarius* profile (*loc. cit.*, fig. 24) it is seen that the "pug-nose" shortening of the snout has been carried almost to an extreme. As a consequence of this simocephalous development, the cleft of the mouth has become nearly vertical. The lower margin of the pre-orbital on the left side is unusually concave, while that on the right side is biconcave. There are only 4 canines in the lower jaw, and the molars are reduced in number in both jaws. The specimen is a ♀ with half-ripe ovaries.

Among the local fishermen this form of Panga is known as the "Dik-bek" Panga, which may be rendered in English as the "Pug-nosed" Panga. Mr. Biden informs me that it used to be common on the deeper banks in False Bay, but within the last twenty years has become very scarce. At Port Elizabeth the name is applied to the ordinary "long-nosed" or "pig-nosed" Panga.

Later Mr. Biden has qualified his statement as to its rarity by obtaining from the Kalk Bay fishermen two more specimens. These are very interesting as showing successive stages in simocephaly. The largest, a 300-mm. ♀, has an almost normal profile, but with

a marked indentation opposite the nostrils. The snout is not much shortened, and the cleft of the mouth normal. The other specimen, a 275-mm. ♂, is intermediate between the larger ♀ and the smaller

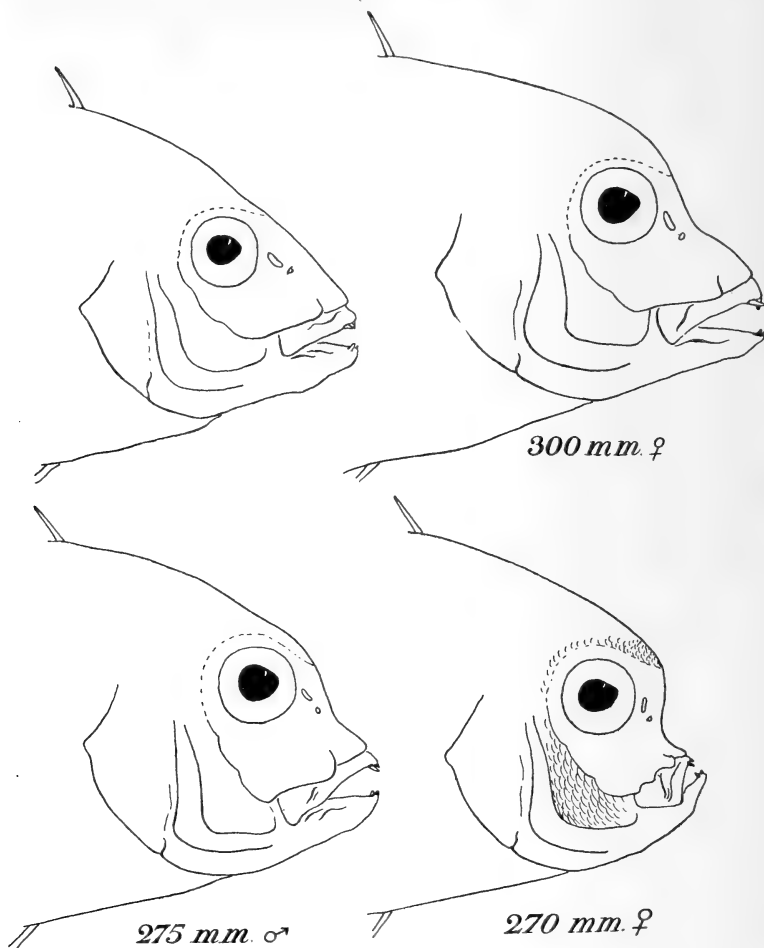


FIG. 4.—*Pagrus laniarius* C. and V. Profiles of normal head and three heads showing successive degrees of simocephaly.

pug-nosed specimen. The snout is distinctly shortened and the cleft of the mouth is oblique. Both these specimens have the normal 6 canines in the lower jaw.

As the greatest amount of simocephaly is shown by the smallest of the three specimens, it must not be assumed that every individual showing a tendency to simocephaly would eventually in the course

of its existence develop into the extreme pug-nosed form. On the contrary the series seems to indicate that the tendency to simocephaly varies in intensity, and that by cross-breeding all gradations from pug-nose to pig-nose are possible (see Gudger, Bull. Amer. Mus. Nat. Hist., 61, 1930, p. 18).

Mola mola and *lanceolata*.

(Text-figs. 5-7.)

Since 1927 the following records of these two Sun-fishes, either stranded or captured, have accumulated:—

(*mola*) January 1929. Table Bay.

(*lanceolata*) March 1930. Table Bay.

(*mola*) August 1931. Table Bay.

(*mola*) December 1931. Camps Bay, west coast of Cape Peninsula.

(*mola*) 12th October 1933. Table Bay.

(*mola*) 27th " " "

(*mola*) December 1933. East London.

(*mola*) July 1934. Kommetje, west coast of Cape Peninsula.

As regards the distinctions between the two species the following points deserve attention:—

A cross-section through the body at the region of the pectoral fin shows in *mola* an elongate hexagonal outline with slightly hollowed lateral sides (fig. 5, *b*). The angles formed by the inclination of the dorso-lateral and ventro-lateral sides with the lateral sides are distinct in the large mounted specimen in the South African Museum measuring 7 feet, but can also be observed in the smaller specimen measuring 3 feet 3 inches (from middle of tail to point of snout).

In contrast to this, *lanceolata* shows a narrow oval-lanceolate outline, widest dorsally and narrowing evenly towards the ventral line (fig. 5, *c*). This outline is constant in two mounted specimens measuring 4 feet 7 inches and 3 feet 11 inches, and in a cast measuring 6 feet 1 inch in length.

Both specimens of *mola* possess a short snout projecting beyond the mouth. A straight line drawn from base of pectoral through middle of gill-opening and eye leads to the apex of this projection. In the specimens of *lanceolata* there is no such projection, the lower jaw forming the most anterior point of the body.

The relative positions of the pectoral fin and the gill-opening show a constant difference in the two species. In *mola* there is a

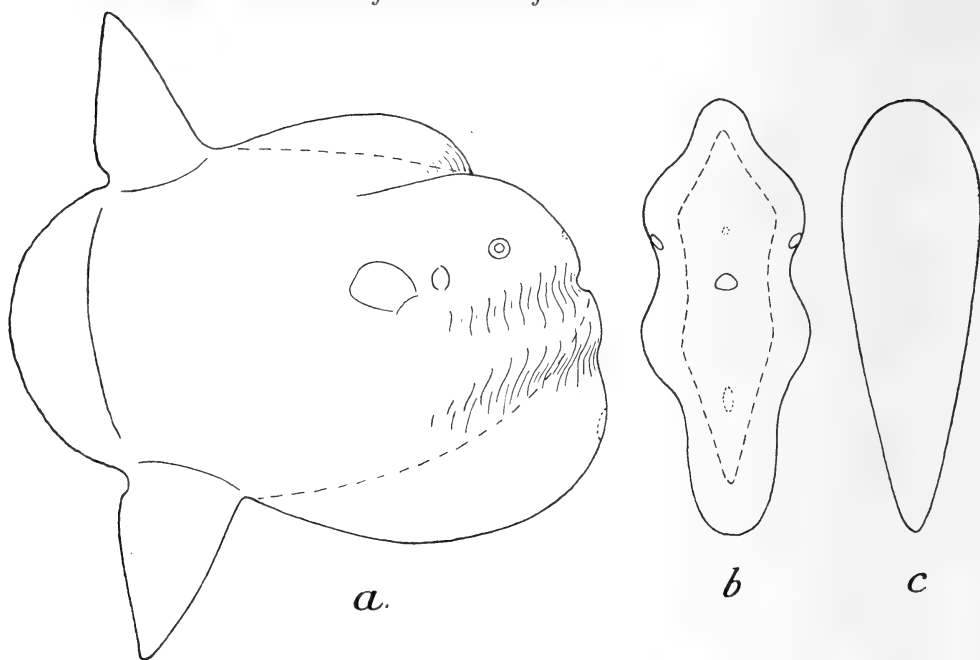


FIG. 5.—*a*, Outline of the Kommetje 1934 Sun-fish; the broken line represents the outline of a normal specimen. *b*, Cross-section of same, the broken line being the normal cross-section in *M. mola*. *c*, Cross-section of *M. lanceolata*.

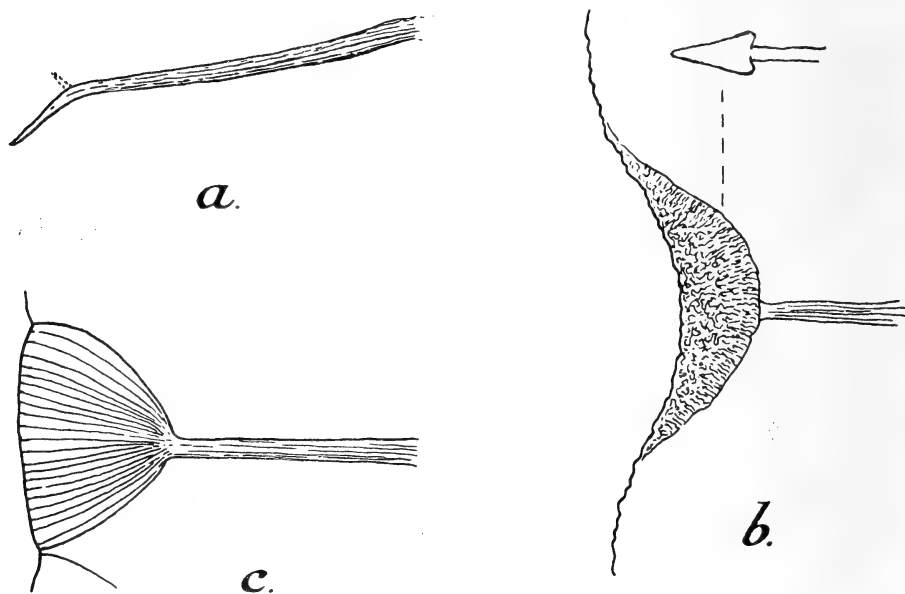


FIG. 6.—Caudal fin-ray of: *a*, *Mola lanceolata*; *b*, *M. mola*, with cross-section; *c*, *Ranzania truncata*. I *a* and *b* the overlying skin removed.

strip of roughened skin between the anterior end of the base of the fin and the posterior edge of the gill-opening; in *lanceolata* there is no such strip, the pectoral fin arising immediately behind the opening. In the cast specimen already mentioned the curved hind margin of the gill-opening even extends behind the anterior end of the pectoral base.

The gill-rakers in *mola* resemble those in *lanceolata*, being concealed beneath thick fleshy skin. (Gill-filaments, see below.)

The caudal fin in *mola* is always rounded-truncate, and more or less scalloped, the indentations being for the most part regularly spaced. At the bottom of each indentation there is a thickening or callosity, visible at least in mounted specimens. In the large specimen there are 10 indentations, in the smaller one 13, definitely on the caudal region and excluding those on the transitional regions between the tail and the dorsal and anal fins. It has been suggested that this truncation and scalloping of the tail is due to injury inflicted on the young Sun-fish. The regularity of the conformation, however, precludes this explanation.

If a dried specimen of *Ranzania truncata* be examined the extraordinary shape of the caudal fin-rays can be easily seen, and also their gradual transition from the normal fin-ray of the dorsal and anal fins. In the caudal fin the ray has a slender basal stalk which suddenly expands like a fan or Borassus palm leaf (fig. 6, c).

In *lanceolata* only those fin-rays at the junctions of the dorsal and anal fins with the caudal fin exhibit a fan structure, those in the caudal fin proper having only a slender stalk which peters out near the fin margin, occasionally with an indication of a small fork (fig. 6, a). In *mola* each of the caudal fin-rays terminates in crescentic osseous callosity situate at the notch between each pair of caudal lobes (fig. 6, b). These callosities may not be prominent in fresh specimens, but in mounted specimens the surrounding skin shrinks so much that they are easily traceable. In *mola*, as in *lanceolata*, the fin-rays between the caudal and the dorsal and anal fins show fan structure.

The general shape of the tail is constant also in *lanceolata*, though the position of the actual point of the tail may vary, thus causing differences in the relative obliquity and lengths of the upper and lower margins. Dissection of the whole tail region of this species might prove interesting.

The 1934 Kommetje specimen, though obviously a specimen of *mola*, was a freak of most extraordinary appearance (fig. 5, a and b). Its chief measurements were as follows: length, 6 feet 4 inches; depth

between anterior ends of bases of dorsal and anal fins 3 feet 10 inches, these two fins respectively 1 foot 9 inches and 2 feet in length, and distance between their tips 7 feet. The tail was evenly convex, showing none of the usual indentations.

In profile the anterior part of the body was pear-shaped, caused by the enormously swollen dorsal and ventral ridges. In addition there were two broad ridges on either side, and perfectly symmetrical on the two sides, one above and one below the eye. A comparison of the cross-section (fig. 5, *b*) with that of a normal specimen shows that these latter ridges correspond with the angles of the hexagonal cross-section, and are merely due to an excessive hypertrophy of the dermis.

Apart from the abnormal growth on the chin, the profile of the mouth and forehead regions is normal, but resembles that of *lanceolata* in having no projecting snout. There is, however, a small circular hollow, in a position corresponding with that of the point of the snout, which apparently is the scar of an osseous tubercle which has been broken off (corresponding with the nasal spine in the larval form). A similar larger oval hollow occurs on the throat region, where in both the mounted specimens in the South African Museum is situated an osseous tubercle or callosity. In *lanceolata* there is no trace of this throat callosity. (See note, p. 658.)

The Table Bay 1930 specimen of *lanceolata*, when freshly taken from the water, was black above as far down as a line joining the eye and the posterior end of base of dorsal fin, silvery below, especially bright on the belly, with a number of small, round, rather ill-defined black or brown spots below the pectoral region.

Gill-filaments.—In December 1933 a strange fish was washed ashore at Cintsa, near East London. From a sketch and the dimensions taken at the time, I had no hesitation in identifying it as *Mola mola*. The fish was buried, but after about three months was dug up. In the slimy mass some very decomposed pieces of the shoulder girdle were found, and also a large number of thin knife-like bones, which were forwarded to me for inspection by Mr. W. L. Wright, Hon. Secretary of the East London Angling Club. The teeth were not found, having probably been removed by the person who buried the fish.

The knife-like bones were a puzzle at first, until it occurred to me to dissect a very old and partially decomposed specimen of *Ranzania truncata*. Similar shaped bones were found, and proved to be the supporting rods of the gill-filaments.

The accompanying figure (fig. 7) shows the structure of these specimens, which measured 55–85 mm. in length. The base is enlarged into a hollowed articular surface, which fits on to the gill-arch. The “back” of the knife is shallowly grooved in the proximal half, the margin near the base showing finely corrugated striae. The blade shows irregularly spaced growth lines; the base and tip are

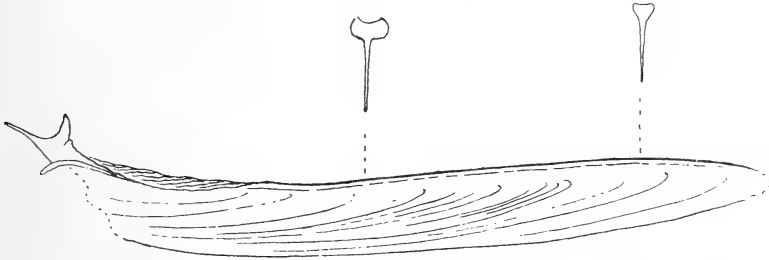


FIG. 7.—*Mola mola*, bone supporting rod of gill-filaments. (Slightly enlarged.)

incomplete in all the specimens. The apices of most of the specimens show a sagittal splitting of both “back” and blade into two halves.

The main reason for illustrating these bones is their interest from an anthropological as well as an ichthyological point of view. Mr. A. J. Goodwin, Department of Anthropology of the University of Cape Town, tells me he has found similar bones in some of the cave deposits he has investigated. The resistant quality of these bones, as opposed to that of the other bones of the Sun-fish, may well ensure their preservation in the moderately dry and well-drained kitchen-middens left by the Strandloopers or early natives. Mr. Goodwin kept no specimens, and if he had it would probably have been impossible to identify them as belonging to any particular kind of fish. Only the size might be some indication.

Ranzania truncata (Retzius).

1927. Barnard, Ann. S. Afr. Mus., xxi, p. 989, fig. 32 (references).

Two further specimens of this species have come to hand and may be recorded:

Inner Basin, Cape Town docks (alive), 23rd December 1932.

Kommetje, Cape Peninsula (washed ashore), 23rd August 1934.

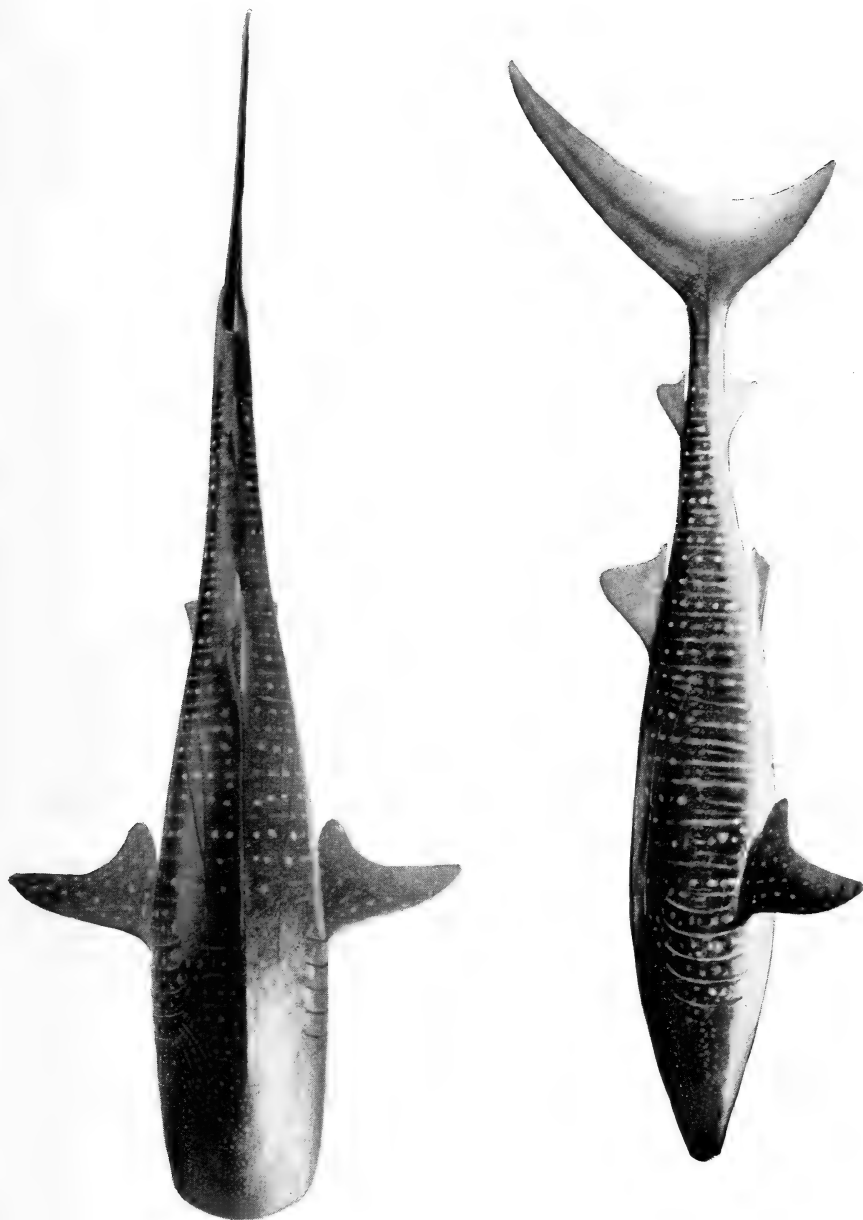
The stomach of the latter specimen contained a large number of the *Megalopa* stage of the common Shore-crab *Plagusia chabrus*.

EXPLANATION OF PLATES.

Rhineodon typus A. Smith.

- Pl. XXIII.—Dorsal and lateral views of the half-scale model constructed for exhibition in the South African Museum.
- Pl. XXIV.—Gill-slits of the right side, showing the 4th gill-slit extending below the origin of the pectoral fin. Photo of the flattened skin, head end above, mid-dorsal line to left, cut ventral edge to right.
- Pl. XXV.—Upper jaw and nostril of the right side from in front (upper figure), from below (lower figure).

Since this paper was in the press, I have received, through the kindness of Mr. J. R. Norman of the British Museum, a tracing of Ranzani's figure of *Orthragoriscus alexandrini* (1839, Nov. Comm. Ac. Sc. Inst. Bonon., iii). This figure closely resembles the Kommetje Sun-fish, having an evenly rounded tail, and prominent convexities on the throat and the forehead, especially on the latter. But neither of these prominencies is so strongly developed as in the South African specimen.

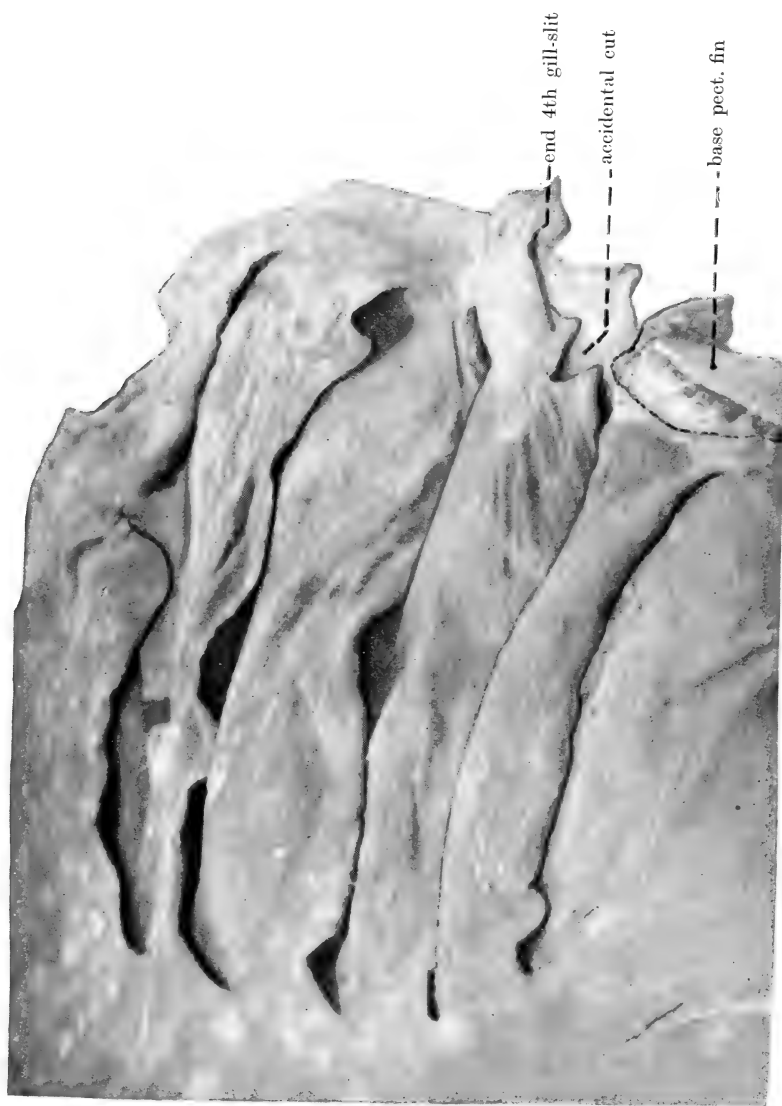


RHINEODON TYPUS A. Smith.

Photo: J. Drury.

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RHINEODON TYPUS A. Smith.





RHINEODON TYPUS A. Smith.



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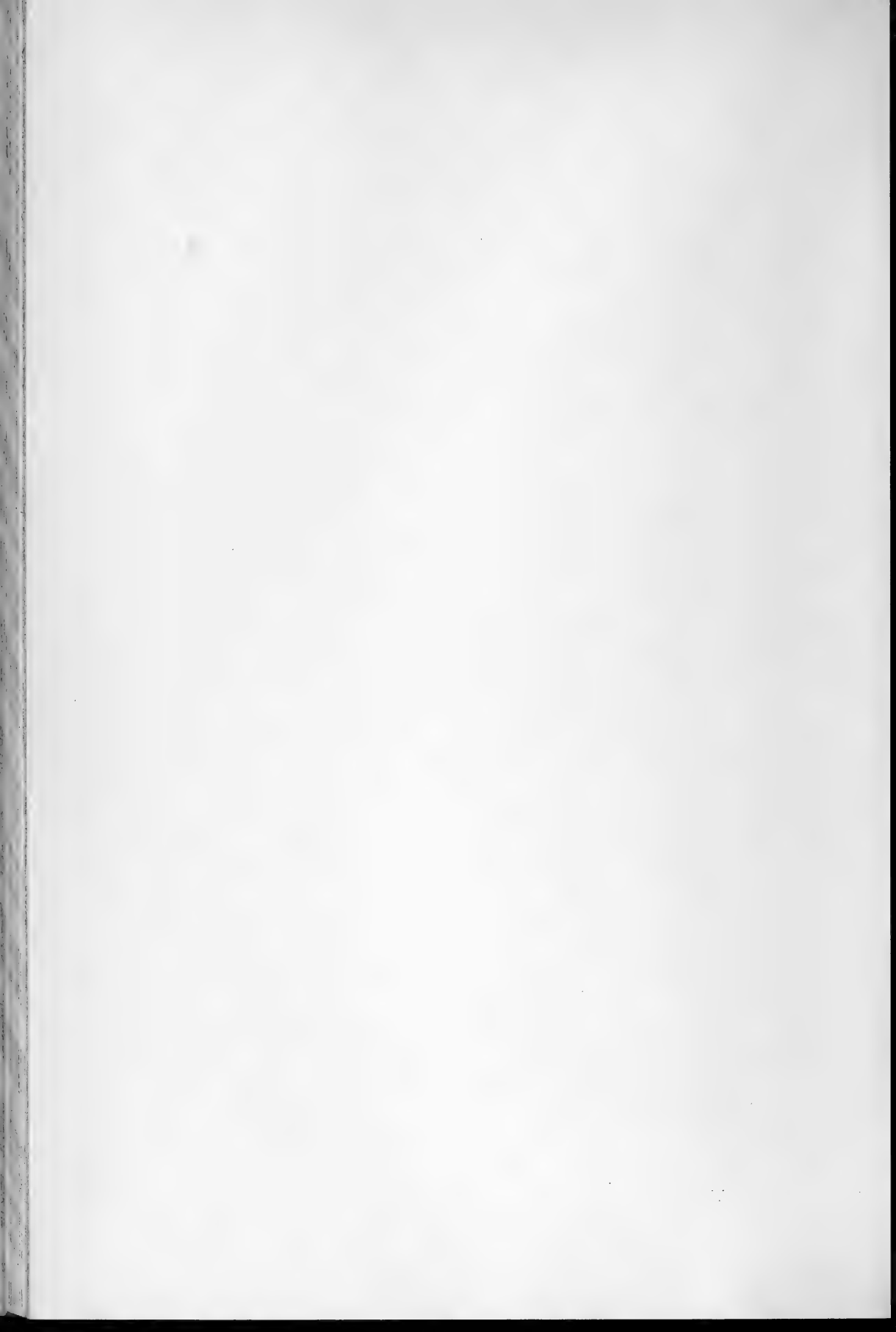
INTRODUCTION.

THE *Annals of the South African Museum* are issued in parts at irregular intervals as material becomes available. They are printed in royal 8vo format.

Most of the Geological and Palaeontological papers published in Volumes IV, VII, XII, XXII, and XXVIII were issued in conjunction with the Geological Commission of the Colony of the Cape of Good Hope, and, later, the Geological Survey of the Union of South Africa.

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Title, Index, etc., contained in Part V.



INDEX OF AUTHORS.

		Volume.	Part.	Year.
ALEXANDER, C. P.	Tipulidae	XVII	2	1917
	"	XVIII	2	1921
ANDREWS, C. W.	Plesiosaur	VII	4	1911
ARNOLD, G.	Monograph (Ants)	XIV	1-6	1915-24
	" („) (Appendix)	XXIII	2	1926
ASHBY, E.	Chitons	XXX	1	1931
ASHWORTH, J. H.	Arenicolidae	XI	1	1911
ATTEMS, C.	Myriopoda	XXVI		1928
AURIVILLIUS, C.	Heterocera	XVIII	2	1921
BAGNALL, R. S.	Thysanoptera	V	8	1910
BARNARD, K. H.	Isopoda	X	7	1914
	"	X	11	1914
	Nebalia	X	11	1914
	Diagnoses, Fishes	XIII	8	1923
	Amphipoda	XV	3	1916
	Isopoda	XVII	5	1920
	Cirripedia	XX	1	1924
	Phyllopoda, S.W.A.	XX	3	1924
	Isop. Terr., S.W.A.	XX	3	1924
	Amph. Isop. (2 papers)	XX	5	1925
	Monogr. Mar. Fishes	XXI	1	1925
	" " "	XXI	2	1927
	Bryozoa, S.W.A.	XXV	1	1927
	Nudibranchs	XXV	1	1927
	Phyllopoda	XXIX	1	1929
	Terrestr. Isopoda	XXX	2	1932
	Stone-flies (Perlaria)	XXX	4	1934
	Marine Fishes (Notes)	XXX	5	1935
(See also RIS, F., XVIII, 3, 1921.)				
BEQUAERT, J.	Synagris (Hymenopt.)	XIX	2	1923
	Eumenes	XXIII	3	1926
BERNHAEUER, M.	Staphylinidae	XXX	4	1934
BEZZI, M.	Bombyliidae	XVIII	1	1921
	"	XVIII	4	1921
	Nemestrinidae	XIX	1	1924
	Mydidae	XIX	1	1924
	Trypaneidae	XIX	3	1924
	Rhagionidae	XXIII	2	1926
BILLECOQ, L. B.	Curculionidae	V	8	1910

		Volume.	Part.	Year.
BLAIR, K. G.	Oedemeridae	XXIII	2	1926
BOLUS, LOUISA.	<i>See</i> PEARSON, H. H. W. (IX, 3, 1913; IX, 4, 1915).			
BOONSTRA, L. D.	Fossil Rept. Amph.	XXVIII	1	1929
	" " "	XXVIII	4	1932
	(See also HAUGHTON, S. H., and BOONSTRA, L. D.)			
BOULENGER, G. A.	New genus of Perciform Fishes	I	2	1899
	Gephyroglanis	II	7	1901
	New Perciform Fishes	III	3	1903
	Paratilapia	III	7	1905
	List of Reptilia and Batrachia	V	9	1910
	Freshwater Fish, Zambesi	XI	7	1918
	Nucas and Eremias	XIII	6	1917
	Freshwater Fish, Rhodesia	XIII	7	1923
BRAUNS, H.	Allodape	XXIII	3	1926
BROOM, R.	New Dicynodonts	I	3	1899
	Fossil Reptiles (6 papers)	IV	2	1903
	" "	IV	8	1908
	" "	V	3	1906
	Orycteropus	V	7	1909
	Fossil Fishes	VII	3	1909
	" Reptiles and Amphibia	VII	3	1909
	" Bubalis	VII	3	1909
	" Horse	VII	3	1909
	" Reptiles	VII	3	1909
	" Vertebrates	VII	3	1909
	" Rept. Dinosaurs	VII	4	1911
	" " (4 papers)	VII	5	1912
	" " (3 papers)	VII	6	1913
	" Fish	XII	1	1913
	" Rept. (2 papers)	XII	1	1913
	Man and Extinct Mammals	XII	1	1913
	Fossil Reptiles (2 papers)	XXII	3	1928
	" Mammals	XXII	3	1928
BROOM, R., and HAUGHTON, S. H.	Fossil Rept. (3 papers)	XII	1	1913
	" "	XII	5	1917
BROWN, N. E.	<i>See</i> PEARSON, H. H. W. (IX, 3, 1913; IX, 4, 1915).			
BRUES, C. T.	Parasitic Hymenoptera	XIX	1	1924
BURR, M.	Earwigs	X	1	1911
CAMERON, P.	Parasitic Hymenoptera	V	2	1906
	" "	V	4	1907
CHAPMAN, F.	Foraminifera and Ostracoda	IV	5	1904
	" "	XII	4	1916
	" Alexandria	XXVIII	2	1930
CLARK, H. L.	Echinoderms (Monograph)	XIII	7	1923
	Clypeaster	XX	5	1925
COHEN, E.	Meteoric Iron, Griqualand	II	2	1900
	" " Bethany	II	2	1900
	" " St. Marks	V	1	1906

		Volume.	Part.	Year.
COLLINGE, W. E.	Slugs (Mollusca)	II	1	1900
	"	II	8	1901
CONNOLLY, M.	F.W. Shells (List)	XI	3	1912
	" (Notes)	XIII	4	1915
	" (")	XIII	5	1916
	" , S.W.A.	XXIX	2	1931
CURRAN, C. H.	Dolichopodidae	XXIII	2	1926
DISTANT, W. L.	Rhynchota	II	9	1902
	"	III	2	1903
	"	X	2	1911
DRENNAN, M. R.	Bushman Dentition	XXIV	1	1929
DRURY, J.	Bushmen of S.W.A.	XXIV	2	1935
DU TOIT, A. L.	Karoo Fossil Plants	XXII	2	1927
	" " "	XXVIII	4	1932
	Uganda " "	XXVIII	4	1932
(See also PÉRINGUEY, L., VIII, 1911; HAUGHTON, S. H., XII, 8, 1924.)				
EDWARDS, F. W.	Culicidae	XIX	1	1924
	Mycetophilidae and Bibionidae	XIX	4	1925
ELLINGSEN, E.	Pseudoscorpion	X	4	1912
ESBEN-PETERSEN, P.	Ephemeridae	X	6	1913
	Bittacidae	XVII	2	1917
	Neuroptera (Ephemer. Megalopt. Embiidina.)	XVII	6	1920
	Megaloptera	XIX	1	1924
FRITSCH, F. E.	Algae	IX	7	1918
GARABEDIAN, STAR	Grasses, S.W.A.	XVI	2	1925
GEYERS, T. W.	Coral, Bokkeveld	XXVIII	1	1929
GILCHRIST, J. D. F.	Ptychodera	VI	2	1908
GILCHRIST, J. D. F., and	Blenniidae	VI	2	1908
THOMPSON, W. W.	Natal Fishes	VI	2	1908
	" " (Part 2)	VI	3	1909
	" " (Part 3)	XI	2	1911
	Freshwater Fishes	XI	5	1913
	" "	XI	6	1917
	" " , Appendix	XI	7	1918
	Natal Fishes (Part 4)	XIII	3	1914
GLOVER, RUTH. See PEARSON, H. H. W.	(IX, 3, 1913; IX, 4, 1915).			
GODDARD, E. J., and MALAN, D. E.	Hirudinea	XI	4	1912
GOODWIN, A. J. H.	Montagu Cave	XXIV	1	1929
	Stone Implements	XXIV	1	1929
	Vosburg Petroglyphs	XXIV	4	1936
	Klip Kop Cave, Hermanus	XXIV	5	1938
GOODWIN, A. J. H., and LOWE, C. VAN R.	Stone Age Cultures, S.A.	XXVII		1929
GOODWIN, A. J. H., and MALAN, B. D.	Mossel Bay Cave	XXIV	3	1935
HAMPSON, Sir G. F.	Moths (Part 1)	II	3	1900
	" (Part 2)	II	10	1902

		Volume.	Part.	Year.
HAMPSON, Sir G. F.	Moths (Part 3)	III	9	1905
HAUGHTON, S. H.	Fossil Rept. and Amphib.	XII	1	1913
	(2 papers)			
	Fossil Rept. and Amphib.	XII	2	1915
	" "	XII	3	1915
	" "	XII	5	1917
	" "	XII	6	1918
	" "	XII	8	1924
	Stormberg Fossils and Strati- graphy	XII	8	1924
	Fossil Rept. and Amphib.	XXII	1	1925
	Cret. Ceph. and Echin.	XXII	1	1925
	Fossil Rept. and Amphib.	XXVIII	1	1929
	Equidae	XXVIII	4	1932
(See also BROOM and HAUGHTON.)				
HAUGHTON, S. H., and	Fossil Rept. and Amphib.	XXVIII	1	1929
BOONSTRA, L. D.	" "	XXVIII	2	1930
	" "	XXVIII	3	1930
HESSE, A. J.	Rhynchota, S.W.A.	XXIII	1	1925
	Curculionidae	XXV	3	1929
	Speleiacris	XXIX	1	1929
	Insects on Gnidia	XXX	3	1934
HEWITT, J.	Rept. Batrach. (2 papers)	XX	6	1926
	Solifugae and Scorp., S.W.A.	XXX	1	1931
HILL, A. W.	See PEARSON, H. H. W. (IX, 2, 1912).			
HUTCHINSON, G. E.	Onychophora	XXV	2	1928
	Notonectidae and Corixidae	XXV	3	1929
HUTCHINSON, J., and	Pteronia	IX	5	1917
PHILLIPS, E. P.				
(See also PEARSON, H. H. W., and HUTCHINSON, J.)				
JANSE, A. J. T.	Lymantridae	XVII	2	1917
KARNY, H. H.	Gryllacridae	XXIX	1	1929
KIEFFER, J. J.	Chironomidae	X	8	1914
	"	XVII	6	1920
KIRKPATRICK, R.	Sponge	XIII	2	1913
KITCHIN, F. L.	Uitenhage Fossils	VII	2	1908
KLEIN, C.	See COHEN, E. (V, 1, 1906).			
LAKE, P.	Trilobites	IV	4	1904
LANG, W. D.	Upper Cretaceous, Polyzoa and Anthozoa	VII	1	1908
LAWRENCE, R. F.	Arachnida, S.W.A.	XXV	1	1927
	" "	XXV	2	1928
	Solifugae	XXIX	1	1929
	Opiliones	XXIX	2	1931
	Peripatopsid	XXX	1	1931
	Solifugae	XXX	1	1931
	Opiliones	XXX	4	1934
LOWE, C. VAN R.	See GOODWIN, A. J. H., and LOWE, C. VAN R.			

		Volume.	Part.	Year.
MALAN, B. D.	<i>See</i> GOODWIN, A. J. H., and MALAN, B. D.			
MALAN, D. E.	<i>See</i> GODDARD, E. J., and MALAN, D. E.			
MASSY, ANNE L.	Cephalopoda	XXV	1	1927
MEYRICK, E.	Microlepidoptera	V	7	1909
	"	V	8	1910
	"	X	3	1912
	"	X	8	1914
	"	XVII	1	1917
	"	XVII	4	1920
	"	XXIII	2	1926
MICHAELSEN, W.	Oligochaeta	XIII	2	1913
MORLEY, C.	Ichneumonidae	XV	5	1916
	"	XVII	3	1917
	"	XXIII	3	1926
MUNRO, H. K.	Trypetidae	XXIX	1	1929
OGILVIE-GRANT, W. R.	Lark	XIII	2	1913
PEARSON, H. H. W.	S.W. African Plants	IX	1	1911
	Orange River Plants	IX	2	1912
	Khamiesberg, etc.	IX	3	1913
	List, Percy Sladen Expeditions (excl. Compositae)	IX	4	1915
PEARSON, H. H. W., and HUTCHINSON, J.	List (Compositae)	IX	6	1917
PÉRINGUEY, L.	Mutillidae	I	1	1898
	Hispiinae	I	1	1898
	5th contribution: Coleoptera	I	2	1899
	Mutillidae	I	2	1899
	New species Mutilla	I	3	1899
	Mutillidae	II	5	1901
	Japyx	II	5	1901
	6th contribution: Coleoptera	III	6	1904
	7th " "	V	6	1908
	Mutillidae	V	7	1909
	Hemerobiidae	V	8	1910
	Stone Ages	VIII		1911
	Hemerobiidae	X	2	1911
	Mutillidae	X	10	1914
	Early Inscriptions	XIII	1	1913
	Orthoptera	XV	5	1916
	Carabidae	XXIII	3	1926
PETERSEN. <i>See</i> ESBEN-PETERSEN.				
PHILLIPS, E. P.	Proteaceae	IX	3	1913
	Tristan d'Acunha Plants	IX	3	1913
	Giftberg Plants	IX	3	1913
	Leucadendron	IX	3	1913
	Contributions to Flora, No. 1	IX	3	1913
	Proteaceae	IX	4	1915
	"	IX	5	1917

		Volume.	Part.	Year.
PHILLIPS, E. P.	Contributions to Flora, No. 2	IX	5	1917
	Cyphia	IX	6	1917
	Calpurnia	IX	6	1917
	Flora of Basutoland	XVI	1	1917
(See also HUTCHINSON and PHILLIPS.)				
PICKARD-CAMBRIDGE, O.	Araneidea	III	5	1904
POCOCK, MARY A.	Volvox	XVI	3	1933
(See also RICH, F., and POCOCK, M. A.)				
POWER, J. H.	Batrachia (Breviceps)	XX	6	1926
(See also POCOCK, MARY A., XVI, 3, 1933.)				
PROUT, L. B.	Geometridae	XVII	1	1917
	"	XIX	4	1925
	"	"	"	"
PURCELL, W. F.	New Scorpions	I	1	1898
	Opisthophthalmus	I	2	1899
	Peripatidae	I	2	1899
	Solifugae	I	3	1899
	New Scorpions	I	3	1899
	Opisthopatus	II	4	1900
	Arachnida	II	6	1901
	Solipugidae	III	1	1903
	Arachnidae	III	1	1903
	"	III	4	1903
	Pselaphidae	II	5	1901
	"	V	8	1910
RAFFRAY, A.	"	X	6	1913
	"	X	11	1914
	"	"	"	"
	"	"	"	"
	"	"	"	"
REED, F. R. C.	Brachiopoda, Bokkeveld	IV	3	1903
	Mollusca, Bokkeveld	IV	6	1904
	Bokkeveld Fossils	IV	8	1908
	"	XXII	1	1925
	"	"	"	"
RENNIE, J. V. L.	Cret. Fossils, Angola	XXVIII	1	1929
	" " Pondoland and Zululand	XXVIII	2	1930
	"	"	"	"
RICARDO, GERTRUDE	Tabanidae	X	11	1914
	"	XVII	6	1920
RICH, FLORENCE, and POCOCK, MARY A.	Volvox	XVI	3	1933
RIS, F.	Odonata	XVIII	3	1921
ROSE, W.	Reptil. Batrach. Field Notes (2 papers)	XX	6	1926
SARS, G. O.	Freshwater Entomostraca.	XV	4	1916
	Cladocera	"	"	"
	Freshwater Entomostraca.	XX	2	1924
	Ostracoda	"	"	"
	Freshwater Entomostraca.	XX	3	1924
	Ostracoda, S.W.A.	"	"	"
	Freshwater Entomostraca.	XXV	1	1927
	Copepoda	"	"	"

		Volume.	Part.	Year.
SCHENKLING, S.	Cleridae	V	4	1907
SCHILDER, F. A.	<i>See</i> TOMLIN, J. R. LE B., and SCHILDER, F. A. (XXX, 3, 1934).			
SCHÖNLAND, S.	<i>See</i> PEARSON, H. H. W. (IX, 2, 1912).			
SCLATER, W. L.	List of Reptiles and Batrachia	I	1	1898
	List of Rodents	I	2	1899
	List of Birds	III	8	1905
SEWARD, A. C.	Fossil Floras	IV	1	1903
SHACKLEFORD, L. J.	Marine Mollusca	XIII	3	1914
	" "	XIII	5	1916
SHAW, M.	Snuff-boxes	XXIV	3	1935
	Supplement to Snuff-boxes	XXIV	5	1938
	Ovambo Knives	XXIV	5	1938
	Pipes and Smoking	XXIV	5	1938
SHRUBSALL, F. C.	Bushman Skeletons	V	5	1907
	" Craniology. <i>See</i> PÉRINGUEY, L. (VIII, 1911).			
SILVESTRI, F.	Japygidae	XXX	1	1931
SIM, T. R.	<i>See</i> PEARSON, H. H. W. (IX, 4, 1915).			
SLOME, D.	Bushman Osteology	XXIV	1	1929
SMITH, J. L. B.	Mugilidae (Fishes)	XXX	5	1935
SPATH, L. F.	Cephalopods	XII	7	1921
	"	XXVIII	2	1930
STEBBING, T. R. R.	S.A. Crustacea (pt. 4)	VI	1	1908
	Catalogue (pt. 5)	VI	4	1910
	S.A. Crustacea (pt. 6)	X	5	1912
	" " (pt. 7)	XV	1	1914
	" " (pt. 8)	XV	2	1915
	" " (pt. 9)	XVII	1	1917
	" " (pt. 10)	XVII	4	1920
	" " (pt. 11)	XVIII	4	1921
	" " (pt. 12)	XIX	1	1924
STEPHENS, EDITH L.	<i>See</i> PEARSON, H. H. W. (IX, 2, 1912).			
THOMPSON, W. W.	<i>See</i> GILCHRIST, J. D. F., and THOMPSON, W. W.			
THOR, S.	Hydrachnids	II	11	1902
TILLYARD, R. J.	Stone-flies (Perlaria)	XXX	1	1931
TOMLIN, J. R. LE B.	Marine Shells: 1 (Turritellidae)	XX	4	1925
	" " : 2 (Abyssochryssidae, Oocorythid., Haliotidae, Tonnidae)	XXV	1	1927
	Marine Shells: 3 (Nassariidae); 4 (Terebridae, etc.)	XXV	2	1928
	Marine Shells: 5 (Scaphopoda)	XXIX	2	1931
	" " : 6-8 (Fasc. Fissurellidae, Buccinidae)	XXX	2	1932
TOMLIN, J. R. LE B., and SCHILDER, F. A.	Marine Shells: 9 (Triviidae)	XXX	3	1934
TUCKER, R. W. E.	Arachnida	XVII	2	1917
	"	XVII	5	1920
	Drassidae	XIX	2	1923
TURNER, R. E.	Scoliidae	XV	6	1916

		Volume.	Part.	Year.
TURNER, R. E.	Fossorial Hymenoptera	XVII	6	1920
UHLMANN, E.	Hispinae (Chrysomelidae)	XXX	3	1934
ULMER, G.	Trichoptera	X	6	1913
UVAROV, B. P.	Orthoptera	XXV	2	1928
	„ (S.W.A.)	XXIX	1	1929
VILLENEUVE, J.	Stomoxys	XV	6	1916
	Tachino-Oestrid.	XV	6	1916
	Myodarii	XV	6	1916
WALTON, J.	Fossil Woods	XXII	1	1925
WARREN, W.	Geometridae, Pyralidae	X	1	1911
	Heterocera	X	12	1914
WATERSTON, J.	Ectoparasites	X	9	1914
WATSON, H.	Onchidella	XX	4	1925
	(See also CONNOLLY, M., XIII, 4, 1915.)			
WEST, G. S.	Algae	IX	2	1912
WOMERSLEY, H.	Protura	XXX	1	1931
	Sminthuridae	XXX	1	1931
	Machilidae	XXX	2	1932
	Collembola-Arthropleona	XXX	3	1934
WOODS, H.	Cretaceous, Pondoland	IV	7	1906
	Upper Cretaceous, Need's Camp	VII	1	1908

INDEX OF SUBJECTS.

The Phyla are arranged in the same order as in the Zoological Record; the groups in the Crustacea, Arachnida, and Insecta are in alphabetical order.

For Palaeontology see under Botany (Fossil); Zoology, under the respective Phyla.

ZOOLOGY.

PROTOZOA (Fossil).

	Volume.	Part.	Year.
<i>Foraminifera.</i>			
CHAPMAN, F.	IV	5	1904
"	XII	4	1916
"	XXVIII	2	1930

PORIFERA (Recent).

KIRKPATRICK, R.	XIII	2	1913
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COELENTERATA (Fossil).

<i>Anthozoa.</i>			
LANG, W. D.	VII	1	1908
KITCHIN, F. L.	VII	2	1908
REED, F. R. C.	XXII	1	1925
GEVERS, T. W.	XXVIII	1	1929

ECHINODERMATA (Fossil).

WOODS, H.	IV	7	1906
"	VII	1	1908
REED, F. R. C.	XXII	1	1925
HAUGHTON, S. H.	XXII	1	1925

ECHINODERMATA (Recent).

CLARK, H. L.	(Monograph)	XIII	7	1923
"	(Clypeaster)	XX	5	1925

VERMES (ANNELIDA) (Fossil).

KITCHIN, F. L.	VII	2	1908
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VERMES (Recent).

<i>Hirudinea.</i>			
GODDARD, E. J., and MALAN, D. E.	XI	4	1912
<i>Oligochaeta.</i>			
MICHAELSEN, W.	XIII	2	1913
<i>Polychaeta.</i>			
ASHWORTH, J. H.	XI	1	1911

		Volume.	Part.	Year.
	BRACHIOPODA (Fossil).			
REED, F. R. C.		IV	3	1903
"		IV	8	1908
WOODS, H.		VII	1	1908
REED, F. R. C.		XXII	1	1925
	POLYZOA (BRYOZOA) (Fossil).			
WOODS, H.		IV	7	1906
LANG, W. D.		VII	1	1908
REED, F. R. C.		XXII	1	1925
	POLYZOA (BRYOZOA) (Recent).			
BARNARD, K. H.	(S.W.A.)	XXV	1	1927
	MOLLUSCA (Fossil).			
REED, F. R. C.	(Cephal. Gastrop. Pterop. Lamellibr.)	IV	6	1904
WOODS, H.	(Lamellibr. Gastrop. Cephal.)	IV	7	1906
REED, F. R. C.	(Gastrop. Pterop. Lamellibr. Brachiop.)	IV	8	1908
WOODS, H.	(Lamellibr. Brachiop.)	VII	1	1908
KITCHIN, F. L.	(Lamellibr. Gastrop. Cephalop.)	VII	2	1908
SPATH, L. F.	(Cephalop.)	XII	7	1921
HAUGHTON, S. H.	(")	XXII	1	1925
REED, F. R. C.		XXII	1	1925
RENNIE, J. V. L.	(Lamellibr. Gastrop.)	XXVIII	1	1929
SPATH, L. F.	(Cephalop.)	XXVIII	2	1930
RENNIE, J. V. L.	(Lamellibr. Gastrop.)	XXVIII	2	1930
	MOLLUSCA (Recent).			
<i>Marine.</i>				
SHACKLEFORD, L. J.	(Marginellid)	XIII	3	1914
"	(")	XIII	5	1916
TOMLIN, J. R. LE B.	(1. Turritellid)	XX	4	1925
"	(2. Abysochysid., etc.)	XXV	1	1927
MASSY, A. L.	(Cephalopoda)	XXV	1	1927
BARNARD, K. H.	(Nudibranchia)	XXV	1	1927
TOMLIN, J. R. LE B.	(3. Nassariidae; 4. Terebrid., etc.)	XXV	2	1928
"	(5. Scaphopoda)	XXIX	2	1931
ASHLY, E.	(Chitons)	XXX	1	1931
TOMLIN, J. R. LE B.	(6-8. Fasciolariid, Fissurellid, Buccinidae)	XXX	2	1932
<i>Non-Marine.</i>				
COLLINGE, W. E.	(Slugs)	II	1	1900
"	(")	II	8	1901
CONNOLLY, M.	(Reference List)	XI	3	1912
"		XIII	4	1915
"		XIII	5	1916
"	(S.W. African)	XXIX	2	1931
WATSON, H.	(Onchidella)	XX	4	1925

		Volume.	Part.	Year.
CRUSTACEA (Fossil).				
CHAPMAN, F.	(Ostracoda)	IV	5	1904
"	(")	XII	4	1916
KITCHIN, F. L.	(Decapod)	VII	2	1908
HAUGHTON, S. H.	(Entomostraca)	XII	8	1924
CRUSTACEA (Recent).				
<i>Amphipoda.</i>				
STEBBING, T. R. R.	(Marine)	VI	1	1908
BARNARD, K. H.	(Marine and Freshwater)	XV	3	1916
STEBBING, T. R. R.	(Marine)	XVII	1	1917
BARNARD, K. H.	(")	XX	5	1925
<i>Cirripedia.</i>				
BARNARD, K. H.		XX	1	1924
<i>Decapoda.</i>				
STEBBING, T. R. R.	(Marine)	VI	1	1908
"	(Sympoda)	X	5	1912
"	(Marine)	XV	1	1914
"	(")	XV	2	1915
"	(")	XVII	1	1917
"	(")	XVII	4	1920
"	(")	XVIII	4	1921
"		XIX	1	1924
<i>Entomostraca (Branchiopoda, Ostracoda, Copepoda).</i>				
SARS, G. O.	(Cladocera)	XV	4	1916
STEBBING, T. R. R.	(Marine Copepoda)	XVII	1	1917
SARS, G. O.	(Ostracoda)	XX	2	1924
"	(Ostracoda, S.W.A.)	XX	3	1924
BARNARD, K. H.	(Phyllop., S.W.A.)	XX	3	1924
SARS, G. O.	(Copepoda)	XXV	1	1927
BARNARD, K. H.	(Phyllopoda)	XXIX	1	1929
<i>General Catalogue S.A. Crustacea.</i>				
STEBBING, T. R. R.		VI	4	1910
<i>Isopoda.</i>				
STEBBING, T. R. R.	(Marine)	VI	1	1908
BARNARD, K. H.	(Marine and Freshwater)	X	7	1914
"	(Marine)	X	11	1914
STEBBING, T. R. R.	(Marine)	XVII	1	1917
BARNARD, K. H.	(Marine)	XVII	5	1920
"	(Terrestr., S.W.A.)	XX	3	1924
"	(Marine)	XX	5	1925
"	(Terrestr.)	XXX	2	1932
<i>Nebalia.</i>				
BARNARD, K. H.		X	11	1914
TRILOBITA.				
LAKE, P.		IV	4	1904
REED, F. R. C.		XXII	1	1925

	Volume.	Part.	Year.
ARACHNIDA.			
<i>Acari.</i>			
LAWRENCE, R. F.	XXV	2	1928
<i>Araneae.</i>			
PURCELL, W. F.	III	1	1903
"	III	4	1903
PICKARD-CAMBRIDGE, O.	III	5	1904
TUCKER, R. W. E.	XVII	2	1917
"	XVII	5	1920
" (Drassidae)	XIX	2	1923
LAWRENCE, R. F.	XXV	1	1927
"	XXV	2	1928
" (Opiliones)	XXIX	2	1931
" (" "	XXX	4	1934
<i>Hydrachnida.</i>			
THOR, S.	II	11	1902
<i>Pedipalpi.</i>			
PURCELL, W. F.	II	6	1901
<i>Pseudoscorpions.</i>			
ELLINGSEN, E.	X	4	1912
<i>Scorpiones.</i>			
PURCELL, W. F.	I	1	1898
"	I	2	1899
"	I	3	1899
"	II	6	1901
LAWRENCE, R. F.	XXV	1	1927
"	XXV	2	1928
HEWITT, J.	XXX	1	1931
<i>Solifugae.</i>			
PURCELL, W. F.	I	3	1899
"	II	6	1901
" (2 papers)	III	1	1903
LAWRENCE, R. F.	XXV	1	1927
"	XXV	2	1928
"	XXIX	1	1929
HEWITT, J.	XXX	1	1931
LAWRENCE, R. F.	XXX	1	1931
MYRIOPODA.			
ATTEMS, C.	XXVI		1928
PROTOTRACHEATA.			
<i>Onychophora (Peripatus).</i>			
PURCELL, W. F.	I	2	1899
"	II	4	1900
HUTCHINSON, G. E.	XXV	2	1928
LAWRENCE, R. F.	XXX	1	1931
INSECTA (Fossil).			
HAUGHTON, S. H.	XII	8	1924

	INSECTA (Recent).	Volume.	Part.	Year.
<i>Anoplura and Mallophaga.</i>				
WATERSON, J.		X	9	1914
<i>Coleoptera.</i>				
PÉRINGUEY, L.	(Hispinae)	I	1	1898
"	(5th contribution)	I	2	1899
RAFFRAY, A.	(Pselaphidae)	II	5	1901
PÉRINGUEY, L.	(6th contribution)	III	6	1904
"	(7th contribution)	V	6	1908
SCHENKLING, S.	(Cleridae)	V	4	1907
RAFFRAY, A.	(Pselaphidae)	V	8	1910
BILLECOQ, L. B.	(Curculionidae)	V	8	1910
RAFFRAY, A.	(Pselaphidae)	X	6	1913
"	(")	X	11	1914
BLAIR, K. G.	(Oedemeridae)	XXIII	2	1926
PÉRINGUEY, L.	(Carabidae)	XXIII	3	1926
HESSE, A. J.	(Curculionid)	XXV	3	1929
"	(On Gnidia)	XXX	3	1934
UHMANN, E.	(Hispinae)	XXX	3	1934
BERNHAEUER, M.	(Staphylinidae)	XXX	4	1934
<i>Collembola.</i>				
WOMERSLEY, H.	(Sminthurid)	XXX	1	1931
"	(Arthropleona)	XXX	3	1934
<i>Dermaptera.</i>				
BURR, M.		X	1	1911
<i>Diptera.</i>				
KIEFFER, J. J.	(Chironomidae)	X	8	1914
RICARDO, G.	(Tabanidae)	X	11	1914
VILLENEUVE, J.	(Stomoxys)	XV	6	1916
"	(Tachino-Oestrid)	XV	6	1916
"	(Myodarii)	XV	6	1916
ALEXANDER, C. P.	(Tipulidae)	XVII	2	1917
KIEFFER, J. J.	(Chironomidae)	XVII	6	1920
RICARDO, G.	(Tabanidae)	XVII	6	1920
BEZZI, M.	(Bombyliidae)	XVIII	1	1921
ALEXANDER, C. P.	(Tipulidae)	XVIII	2	1921
BEZZI, M.	(Bombyliidae)	XVIII	4	1921
EDWARDS, F. W.	(Culicidae)	XIX	1	1924
"	(Mycetophilidae, Bibionidae)	XIX	4	1925
BEZZI, M.	(Nemestrinidae)	XIX	1	1924
"	(Mydidae)	XIX	1	1924
"	(Trypanidae)	XIX	3	1924
"	(Rhagionidae)	XXIII	2	1926
CURRAN, C. H.	(Dolichopodidae)	XXIII	2	1926
MUNRO, H. K.	(Trypaetidae)	XXIX	1	1929
HESSE, A. J.	(Insects on Gnidia)	XXX	3	1934

		Volume.	Part.	Year.
<i>Embiaria.</i>				
PETERSEN, P. ESSEN		XVII	6	1920
<i>Ephemeroptera.</i>				
PETERSEN, P. E.		X	6	1913
"		XVII	6	1920
<i>Hemiptera (Rhynchota).</i>				
DISTANT, W. L.		II	9	1902
"		III	2	1903
"		X	2	1911
HESSE, A. J.	(S.W.A.)	XXIII	1	1925
HUTCHINSON, G. E.		XXV	3	1929
<i>Hymenoptera.</i>				
PÉRINGUEY, L.	(Mutillidae)	I	1	1898
"	(")	I	2	1899
"	(")	I	3	1899
"	(")	II	5	1901
"	(")	V	7	1909
"	(")	X	10	1914
CAMERON, P.	(Parasitic Hymenoptera)	V	2	1906
"	(" ")	V	4	1907
ARNOLD, G.	(Ants, monograph)	XIV	1-6	1915-24
MORLEY, C.	(Ichneumonidae, Part 1)	XV	5	1916
TURNER, R. E.	(Scoliidae)	XV	6	1916
MORLEY, C.	(Ichneumonidae, Part 2)	XVII	3	1917
TURNER, C.	(Fossorial)	XVII	6	1920
BRUES, C. T.	(Parasitic Hymenoptera)	XIX	1	1924
BEQUAERT, J.	(Synagris)	XIX	2	1923
ARNOLD, G.	(Ants, Appendix)	XXIII	2	1926
BRAUNS, H.	(Allodape)	XXIII	3	1926
MORLEY, C.	(Ichneumonidae)	XXIII	3	1926
BEQUAERT, J.	(Eumenes)	XXIII	3	1926
HESSE, A. J.	(On Gnidia)	XXX	3	1934
<i>Lepidoptera.</i>				
HAMPSON, G. F.	(Moths)	II	3	1900
"	(")	II	10	1902
"	(")	III	9	1905
MEYRICK, E.	(Microlep.)	V	7	1909
"	(")	V	8	1910
WARREN, J.	(Geometr. Pyralid.)	X	1	1911
MEYRICK, E.	(Microlep.)	X	3	1912
"	(")	X	8	1914
WARREN, W.	(Heterocera)	X	12	1914
MEYRICK, E.	(Microlep.)	XVII	1	1917
"	(")	XVII	4	1920
PROUT, L. B.	(Geometr.)	XVII	1	1917
JANSE, A. J. T.	(Lymantrid.)	XVII	2	1917

		Volume.	Part.	Year.
AURIVILLIUS, C.	(Heterocera.)	XVIII	2	1921
PROUT, L. B.	(Geometr.)	XIX	4	1925
MEYRICK, E.	(Microlep.)	XXIII	2	1926
HESSE, A. J.	(Insects on Gnidia)	XXX	3	1934
<i>Mecoptera (Bittacidae).</i>				
PETERSEN, P. ESBEN		XVII	2	1917
<i>Neuroptera.</i>				
PÉRINGUEY, L.	(Hemerobiidae)	V	8	1910
"	(")	X	2	1911
PETERSEN, P. ESBEN	(Megaloptera)	XVII	6	1920
"	(")	XIX	1	1924
<i>Odonata (Paraneuroptera).</i>				
RIS, F.		XVIII	3	1921
<i>Orthoptera.</i>				
PÉRINGUEY, L.		XV	5	1916
UVAROV, B. P.		XXV	2	1928
"	(S.W.A.)	XXIX	1	1929
KARNY, H. H.	(Gryllacridae)	XXIX	1	1929
HESSE, A. J.	(Speleiacris)	XXIX	1	1929
<i>Plecoptera (Perlaria).</i>				
TILLYARD, R. J.		XXX	1	1931
BARNARD, K. H.		XXX	4	1934
<i>Protura.</i>				
WOMERSLEY, H.		XXX	1	1931
<i>Siphonaptera.</i>				
WATERSON, J.		X	9	1914
<i>Thysanoptera.</i>				
BAGNALL, R. S.		V	8	1910
HESSE, A. J.		XXX	3	1934
<i>Thysanura.</i>				
PÉRINGUEY, L.	(Japyx)	II	5	1901
SILVESTRI, F.	(Japygidae)	XXX	1	1931
WOMERSLEY, H.	(Machilidae)	XXX	2	1932
<i>Trichoptera.</i>				
ULMER, G.		X	6	1913
PROCHORDATA.				
GILCHRIST, J. D. F.	(Ptychodera)	VI	2	1908
PISCES (Fossil).				
BROOM, R.		VII	3	1909
"		XII	1	1913
HAUGHTON, S. H.		XII	8	1924

		Volume.	Part.	Year.
<i>Freshwater.</i>				
	PISCES (Recent).			
BOULENGER, G. A.		II	7	1901
"		III	7	1905
"		XI	7	1918
"		XIII	7	1923
GILCHRIST, J. D. F., and THOMPSON, W. W.		XI	5	1913
GILCHRIST, J. D. F., and THOMPSON, W. W.		XI	6	1917
<i>Marine.</i>				
BOULENGER, G. A.	(Percoid)	I	2	1899
"	(")	III	3	1903
GILCHRIST, J. D. F., and THOMPSON, W. W.	(Blenniidae)	VI	2	1908
GILCHRIST, J. D. F., and THOMPSON, W. W.	(Natal Fishes)	VI	2	1908
GILCHRIST, J. D. F., and THOMPSON, W. W.	(Natal Fishes, Part 2)	VI	3	1909
GILCHRIST, J. D. F., and THOMPSON, W. W.	(" , " , Part 3)	XI	2	1911
GILCHRIST, J. D. F., and THOMPSON, W. W.	(" , " , Part 4)	XIII	3	1914
BARNARD, K. H.		XIII	8	1923
"	(Monograph)	XXI	1	1925
"	(")	XXI	2	1927
"	(Notes)	XXX	5	1935
SMITH, J. L. B.	(Mugilidae)	XXX	5	1935
REPTILIA AND BATRACHIA (Fossil).				
BROOM, R.		I	3	1899
"	(6 papers)	IV	2	1903
"		IV	8	1908
"		V	3	1906
"	(3 papers)	VII	3	1909
"		VII	4	1911
ANDREWS, C. W.		VII	4	1911
BROOM, R.	(4 papers)	VII	5	1912
"	(3 papers)	VII	6	1913
"	(2 papers)	XII	1	1913
BROOM, R., and HAUGHTON, S. H.	(3 papers)	XII	1	1913
HAUGHTON, S. H.	(2 papers)	XII	1	1913
"		XII	2	1915
"		XII	3	1915
BROOM, R., and HAUGHTON, S. H.		XII	5	1917
HAUGHTON, S. H.		XII	5	1917
"		XII	6	1918

		Volume.	Part.	Year.
HAUGHTON, S. H.		XII	8	1924
"		XXII	1	1925
BROOM, R.	(2 papers)	XXII	3	1928
HAUGHTON, S. H.	(2 papers)	XXVIII	1	1929
HAUGHTON, S. H., and BOONSTRA, L. D.		XXVIII	1	1929
BOONSTRA, L. D.	(2 papers)	XXVIII	1	1929
HAUGHTON, S. H. and BOONSTRA, L. D.		XXVIII	2	1930
HAUGHTON, S. H. and BOONSTRA, L. D.		XXVIII	3	1930
BOONSTRA, L. D.	(2 papers)	XXVIII	4	1932
REPTILIA AND BATRACHIA (Recent).				
SCLATER, W. L.	(List)	I	1	1898
BOULENGER, G. A.	(List)	V	9	1910
"	(Nucras and Eremias)	XIII	6	1917
HEWITT, J.	(2 papers)	XX	6	1926
ROSE, W.	(Field Notes) (2 papers)	XX	6	1926
POWER, J. H.	(Breviceps)	XX	6	1926
AVES.				
SCLATER, W. L.	(List)	III	8	1905
OGILVIE-GRANT, W. R.		XIII	2	1913
MAMMALIA (Fossil).				
BROOM, R.	(Bubalis)	VII	3	1909
"	(Horse)	VII	3	1909
"	(Man, etc.)	XII	1	1913
"	(Kimberley, pig, horses)	XXII	3	1928
HAUGHTON, S. H.	(Equidae)	XXVIII	4	1932
MAMMALIA (Recent).				
SCLATER, W. L.	(Rodents, list)	I	2	1899
BROOM, R.	(Orycteropus)	V	7	1909
ANTHROPOLOGY AND ETHNOLOGY.				
SHRUBSALL, F. C.	(Bushman Skeleton)	V	5	1907
"	(Bushman Craniology)	VIII		1911
PÉRINGUEY, L.	(Stone Ages)	VIII		1911
BROOM, R.	(Man and Extinct Vertebrates)	XII	1	1913
GOODWIN, A. J. H.	(Montagu Cave)	XXIV	1	1929
"	(Caspian and S. African Stone Implements)	XXIV	1	1929
SLOME, D.	(Bushman Osteology)	XXIV	1	1929
DRENNAN, M. R.	(Bushman Dentition)	XXIV	1	1929
DRURY, J.	(Bushmen of S.W. Africa)	XXIV	2	1935
GOODWIN, A. J. H., and MALAN, B. D.	(Mossel Bay Cave)	XXIV	3	1935

		Volume.	Part.	Year
SHAW, M.	(Snuff-boxes)	XXIV	3	1935
GOODWIN, A. J. H.	(Vosburg Petroglyphs)	XXIV	4	1936
"	(Klip Kop Cave, Hermanus)	XXIV	5	1938
SHAW, M.	(Supplement to Snuff-boxes)	XXIV	5	1938
"	(Ovambo Knives)	XXIV	5	1938
"	(Pipes and Smoking in S.A.)	XXIV	5	1938
GOODWIN, A. J. H., and LOWE, C. VAN R.	(Stone Age Cultures)	XXVII		1929

ARCHAEOLOGY.

PÉRINGUEY, L.	(Early Inscriptions)	XIII	1	1913
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BOTANY (Fossil).

SEWARD, A. C.		IV	1	1903
DU TOIT, A. L.	(List, Stormberg)	XII	8	1924
WALTON, J.		XXII	1	1925
DU TOIT, A. L.	(Karoo)	XXII	2	1927
"	(Karoo and Uganda)	XXVIII	4	1932

BOTANY (Recent).

PEARSON, H. H. W.	(S.W. Africa)	IX	1	1911
"	(Orange River, Itinerary)	IX	2	1912
PEARSON, H. H. W., and Others	(Orange River Plants)	IX	2	1912
WEST, G. S.	(Algae)	IX	2	1912
PHILLIPS, E. P.	(3 papers)	IX	3	1913
"	(Tristan d'Acunha Flora)	IX	3	1913
PEARSON, H. H. W.		IX	3	1913
"		IX	4	1915
PHILLIPS, E. P.		IX	4	1915
HUTCHINSON, J., and PHILLIPS, E. P.		IX	5	1917
PHILLIPS, E. P.	(2 papers)	IX	5	1917
PEARSON, H. H. W., and HUTCHINSON, J.		IX	6	1917
PHILLIPS, E. P.	(2 papers)	IX	6	1917
FRITSCH, F. E.	(Algae)	IX	7	1918
PHILLIPS, E. P.	(Basutoland)	XVI	1	1917
GARABEDIAN, S.	(Grasses, S.W.A.)	XVI	2	1925
RICH and POCOCK	(Volvox)	XVI	3	1933
POCOCK	(")	XVI	3	1933

GEOLOGY.

COHEN, E.	(Meteoric Irons) (2 papers)	II	2	1900
COHEN, E. (ed. KLEIN, C.)	(")	V	1	1906
HAUGHTON, S. H.	(Stratigraphy, Stormberg)	XII	8	1924



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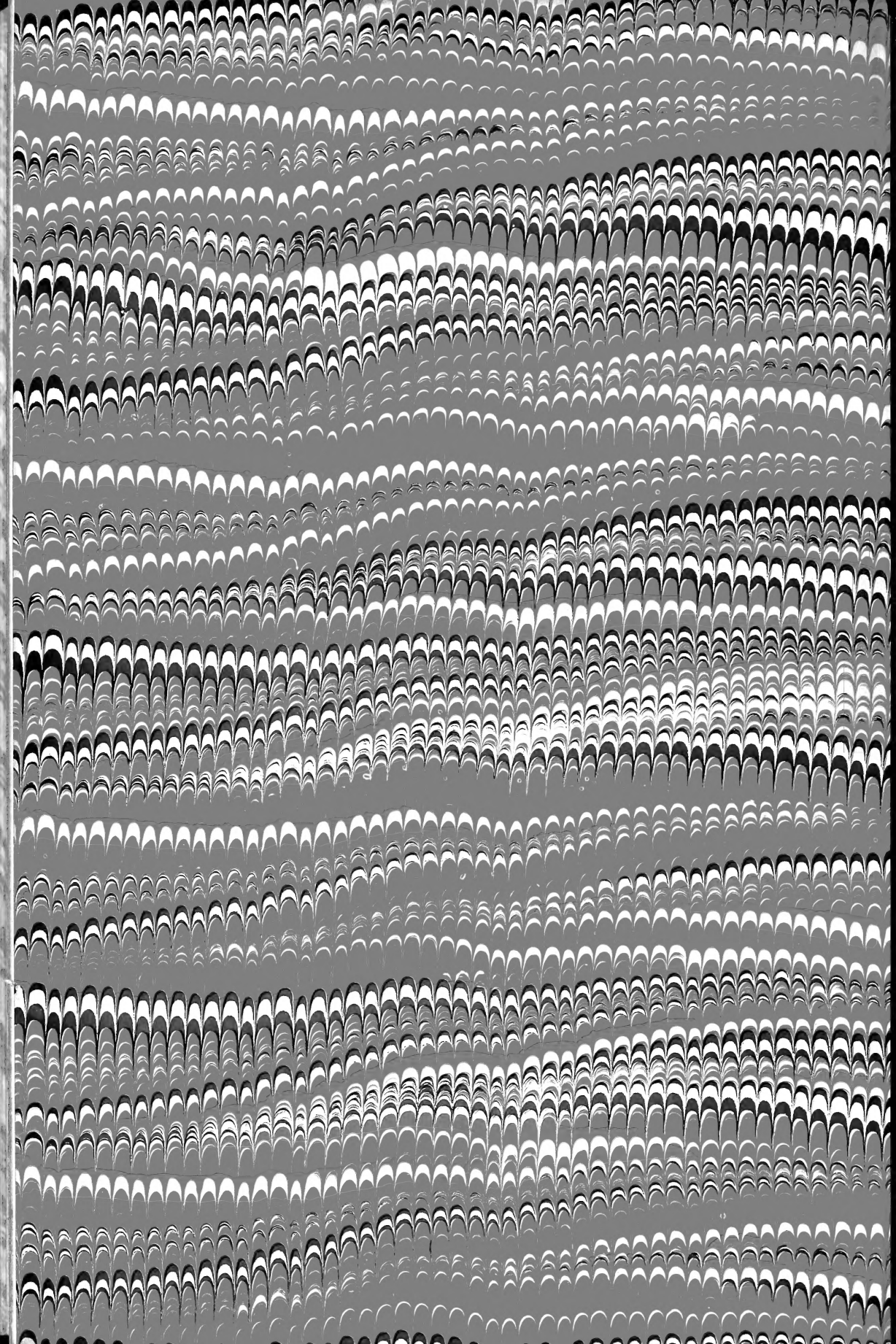
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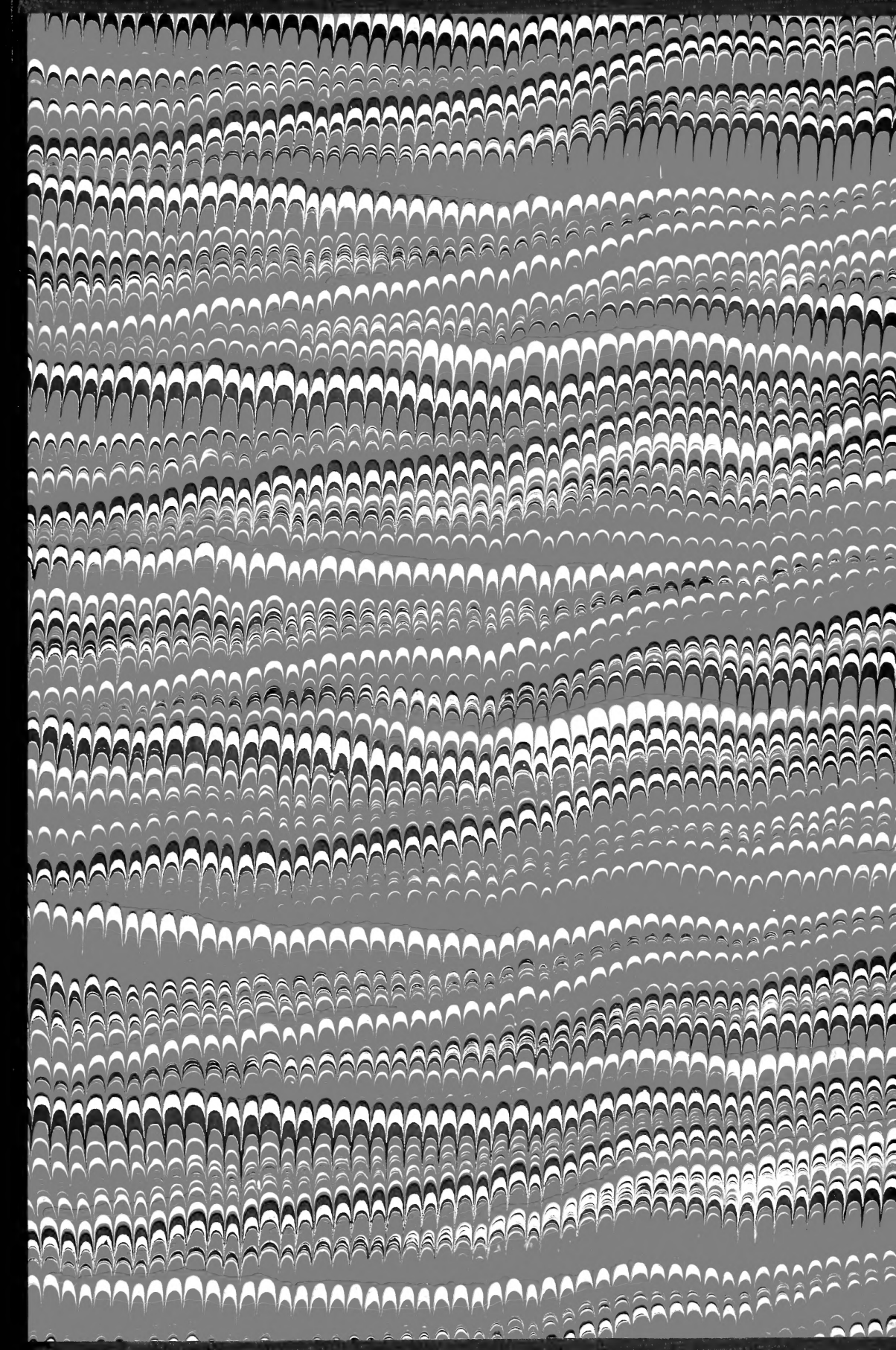
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